This is a digital copy of a book that was preserved for generations on library shelves before it was carefully scanned by Google as part of a project to make the world's books discoverable online.

It has survived long enough for the copyright to expire and the book to enter the public domain. A public domain book is one that was never subject to copyright or whose legal copyright term has expired. Whether a book is in the public domain may vary country to country. Public domain books are our gateways to the past, representing a wealth of history, culture and knowledge that's often difficult to discover.

Marks, notations and other marginalia present in the original volume will appear in this file - a reminder of this book's long journey from the publisher to a library and finally to you.

Usage guidelines

Google is proud to partner with libraries to digitize public domain materials and make them widely accessible. Public domain books belong to the public and we are merely their custodians. Nevertheless, this work is expensive, so in order to keep providing this resource, we have taken steps to prevent abuse by commercial parties, including placing technical restrictions on automated querying.

We also ask that you:

+ *Make non-commercial use of the files* We designed Google Book Search for use by individuals, and we request that you use these files for personal, non-commercial purposes.

+ *Refrain from automated querying* Do not send automated queries of any sort to Google's system: If you are conducting research on machine translation, optical character recognition or other areas where access to a large amount of text is helpful, please contact us. We encourage the use of public domain materials for these purposes and may be able to help.

+ *Maintain attribution* The Google "watermark" you see on each file is essential for informing people about this project and helping them find additional materials through Google Book Search. Please do not remove it.

+ *Keep it legal* Whatever your use, remember that you are responsible for ensuring that what you are doing is legal. Do not assume that just because we believe a book is in the public domain for users in the United States, that the work is also in the public domain for users in other countries. Whether a book is still in copyright varies from country to country, and we can't offer guidance on whether any specific use of any specific book is allowed. Please do not assume that a book's appearance in Google Book Search means it can be used in any manner anywhere in the world. Copyright infringement liability can be quite severe.

About Google Book Search

Google's mission is to organize the world's information and to make it universally accessible and useful. Google Book Search helps readers discover the world's books while helping authors and publishers reach new audiences. You can search through the full text of this book on the web at `http://books.google.com/`

BOSTON
MEDICAL LIBRARY
8 THE FENWAY

MEDICAL ELECTROLOGY

AND

RADIOLOGY

17229

AN INTERNATIONAL MONTHLY REVIEW

(WITH WHICH IS INCORPORATED "THE JOURNAL OF PHYSICAL THERAPEUTICS")

EDITED BY

ARCHIBALD D. REID, M.R.C.S., L.R.C.P., Lond.

AMERICAN EDITOR, DR. M. A. CLEAVES

VOL. V.

1904

LONDON

A. SIEGLE

2, LANGHAM PLACE, W.

1905.

ON MEDIC
APR 14 1919
LIBRARY
CATALOGUE
APR 14 1919
A. E. C.

INDEX TO VOLUME V.

American Electro-Medical Society, p. 20, vol. 5, No. 1.
American Röntgen Ray Society, p. 58, vol. 5, No. 1.
American Electrotherapeutic Association, p. 21, vol. 5, No. 1; p. 126, vol. 5, No. 3.
American Medical Literature, digest of, p. 98, vol. 5, No. 2; p. 122, vol. 5, No. 3; p. 166, vol. 5, No. 4; p. 210, vol. 5, No. 5; p. 251, vol. 5, No. 6; p. 299, vol. 5, No. 7; p. 341, vol. 5, No. 8; p. 435, vol. 5, No. 12.
Appendix, p. 208, vol. 5, No. 5.
Appendix sinus, p. 256, vol. 5, No. 6.
Anachlorhydria, p. 148, vol. 5, No. 4.
Abdominal muscles, p. 286, vol. 5, No. 7.
Alopecia areata, p. 460, vol. 5, No. 12.
Annual Dinner, p. 311, vol. 5, No. 7.
Alternating current, triphase, p. 236, vol. 5, No. 6; p. 286, vol. 5, No. 7.
Aerotherapy, p. 339, vol. 5, No. 8.
Arsenic, testing, p. 333, vol. 5, No. 8.
Asthma, bronchial, p. 202, vol. 5, No. 5,

Banquet Rivière, p. 26, vol. 5, No. 1.
Bread and fruit diet, p. 165, vol. 5, No. 4.

British Electrotherapeutic Society, annual conversazione of, p. 28, vol. 5, No. 1.
British Electrotherapeutic Society, proceedings of, p. 37, vol. 5, No. 1; p. 85, vol. 5, No. 2; p. 129, vol. 5, No. 3; p. 170, vol. 5, No. 4; p. 212, vol. 5, No. 5; p. 254, vol. 5, No. 6; p. 301, vol. 5, No. 7; p. 418, vol. 5, No. 11; p. 445, vol. 5, No. 12.
Blue light, technic and effect of treatment, p. 290, vol 5, No. 7.
Blue light and tuberculosis, p. 198, vol. 5, No. 5.
Bilateral facial atrophy, report of a case, p. 292, vol. 5, No. 7.
Blemishes of the skin, p. 469, vol. 5, No. 12.
Bristol General Hospital, p. 410, vol. 5, No. 11.
Bronchitis, chronic, p. 200, vol. 5, No. 5.
Bronchiectasis, p. 201, vol. 5, No. 5.

Catarrh, p. 201, vol. 5, No. 5; of Lænnec, dry, p. 201, vol. 5, No. 5.
Constipation, treatment of, p. 285, vol. 5, No. 7.
Cancer, p. 441, vol. 5, No. 12.
Cancer, internal, p. 334, vol. 5, No. 8.
Correspondence, p. 253, vol. 5, No. 6; p. 293, vol. 5, No. 7.
Carcinoma, cutaneous, p. 156, vol. 5, No. 4; of anus and rectum, p. 156, vol. 5, No. 4.
Carcinoma of rectum, primary, p. 44, vol. 5, No. 1; of pelvis, p. 156, vol. 5, No. 4.
Carcinoma of the head and neck, p. 156, vol. 5, No. 4 of abdomen, p. 156, vol. 5, No. 4.
Comments and Abstracts, p. 363, vol. 5, No. 9.
Colic, intestinal, p. 232, vol. 5, No. 6.
Carcimona of the breast, p. 166, vol. 5, No. 4.
Carcinoma of breast, recurrent, p. 44, vol. 5, No. 1; primary, p. 156, vol. 5, No. 4.
Constipation, dietary treatment of, p. 98, vol. 5, No. 2.

Diabetes, p. 42, vol. 5, No. 1.
Douche, hydro-electric, p. 235, vol. 5, No. 6.

Editorial, p. 7, vol. 5, No. 1; p. 59, vol. 5, No. 2; p. 99, vol. 5, No. 3; p. 143, vol. 5, No. 4; p. 183, vol. 5, No. 5; p. 225, vol. 5, No. 6; p. 275, vol. 5, No. 7; p. 315, vol. 5, No. 8; p. 343, vol. 5, No. 9; p. 365, vol. 5, No. 10; p 403, vol. 5, No. 11; p. 431, vol. 5, No. 12.
Editorial, 1904, p. 8, vol. 5, No. 1; p. 83, vol. 5, No. 2; p. 102, vol. 5, No. 3; p. 154, vol. 5, No. 4; p. 199, vol. 5, No. 5.
Embryonic growths, treatment of by electrolysis, p. 77, vol. 5, No. 2.
Equestrian therapeutics, p. 128, vol. 5, No. 3.
Electrical accident in a bath, p. 163, vol. 5, No. 4.
Electrodes, special, p. 301, vol. 5, No. 7.
Ergotherapy, p. 339, vol. 5, No. 8.
Enteritis, chronic, p. 234, vol. 5, No. 6.
Eczema, the treatment of, p. 461, vol. 5, No. 12.
Electrical Congress, St. Louis, p. 330, vol. 5, No. 8.
Electrotherapeutics, p. 199, vol. 5, No. 5; present position and future prospects of, p. 445, vol. 5, No. 12.
Electrotherapy, p. 333, vol. 5, No. 8.

Epithelioma, p. 465, vol. 5, No. 12.
Epethelioma of cheek, recurrent, p. 44, vol. 5, No. 1.
Electric osmose, p. 426, vol. 5, No. 11.

Fluorescent transillumination of our stomach, p. 250, vol. 5, No. 6.
Finsen treatment, p. 114, vol. 5, No. 3.
Faith in healing, the element of, p. 125, vol. 5, No. 3.

Gastro-intestinal tract, treatment of, by electrical methods, p. 16, vol. 5, No. 1; p. 73, vol. 5, No. 2; p. 100, vol. 5, No. 3; p. 145, vol. 5, No. 4; p. 184, vol. 5, No. 5; p. 232, vol. 5, No. 6; p. 285, vol. 5, No. 7.
Galvanic current, the constant, p. 146, vol. 5, No. 4; p. 186, vol. 5, No. 5; p. 287, vol. 5, No. 7.
Gaiffe's new apparatus, p. 372, vol. 5, No. 10.
Gout, p. 176, vol. 5, No. 4.
Gout and goutiness, p. 42, vol. 5, No. 1.

Hypertrophic pharyngitis and laryngitis, treatment of, p. 337, vol. 5, No. 8.
Heart wall, bullet lodged in, p. 18, vol. 5, No. 1.
Hypnotic therapeutics, p. 142, vol. 5, No. 3,
Hypochylia, p. 148, vol. 5, No. 4.
High frequency currents, cases treated by, p. 40, vol. 5, No. 1; methods of application of, p. 60, vol. 5, No. 2; p. 105, vol. 5, No. 3; p. 150, vol. 5, No. 4; p. 191, vol. 5, No. 5; p. 237, vol. 5, No. 6; p. 278, vol. 5, No. 7; p. 322, vol. 5, No. 8; p. 349, vol. 5, No. 9; p. 393, vol. 5, No. 10; p. 408, vol. 5, No. 11; rheumatoid arthritis, p. 48, vol. 5, No. 1.
Hyperchlorhydria, treatment of, p. 103, vol. 5, No. 3; clinical notes of a case, p. 123, vol. 5, No. 3.
Hot air, p. 142, vol. 5, No. 3.
Hiccough, persistent, p. 232, vol. 5, No. 6.
Hydrotherapy, physiologic and clinical aspects of, p. 328, vol. 5, No. 8.
Hæmorrhoids, p. 43, vol. 5, No. 1; treatment of, p. 335, vol. 5, No. 8.
Heat and its therapeutics, p. 112, vol. 5, No. 3.
High frequency currents (Gaiffe), p. 372, vol. 5, No. 10.
Heart, p. 333, vol. 5, No. 8.
High frequency currents, p. 389, vol. 5, No. 10; p. 258, vol. 5, No. 6; p. 287, vol. 5, No. 7.
High frequency, p. 87, vol. 5, No. 2; p. 122, vol. 5, No. 3; p. 186, vol. 5, No. 5; p. 235, vol. 5, No. 6; p. 317, vol. 5, No. 8; p. 383, vol. 5, No. 10; p. 468, vol. 5, No. 12.

Igasol and formic acid, p. 321, vol. 5, No. 8.
Intermittent currents, study of, p. 367, vol. 5, No. 10.
Induction coil current, p. 287, vol. 5, No. 7.
Induction coil current of high tension, the, p. 146, vol. 5, No. 4.

Light Cure and Electrotherapeutic Institute, Ltd., p. 57, vol. 5, No. 1.
Light, p. 112, vol. 5, No. 3; p. 252, vol. 5, No. 6; p. 438, vol. 5, No. 12; coloured, p, 113, vol. 5, No. 3; measurement of, p. 115, vol. 5, No. 3.
Laymen, invasion of medical practice by, p. 124, vol. 5, No. 3.
Living tissue, artificial fluorescence of, p. 167, vol. 5. No. 4.
Livett's rectifier, p. 37, vol. 5. No. 1.
Lupus erythermatosus, p. 469, vol. 5, No. 12.
Lupus, treatment of, p. 456, vol. 5, No. 12.
Lupus erythermatosus, p. 460, vol. 5, No. 12.
Lupus, p. 41, vol. 5, No. 1; treated with radium, p. 86, vol. 5, No. 2.
Lupus vulgaris, p. 47, vol. 5, No. 1; p. 156, vol. 5, No. 4; p. 452, vol. 5, No. 12; p. 459, vol. 5, No. 12; p. 469, vol. 5, No. 12.

Massage and writer's cramp, p. 300, vol. 5, No. 7.
Morton current, p. 287, vol. 5, No. 7.
Moles and other birth marks, X-rays in the treatment of, p. 464, vol. 5, No. 12.
Medication, electrical methods of local, p. 418, vol. 5, No. 11.

New instruments and apparatus, p. 117, vol. 5, No. 3.
Notes, p. 400, vol. 5, No. 10.
Newest lamp, p. 470, vol. 5, No. 12.
New instruments and appliances, p. 298, vol. 5, No. 7.
Necrosis, Röntgen ray, p. 251, vol. 5, No. 6.
Notes and Abstracts: electro-chemistry, p. 333, vol. 5, No. 8.
Notes and Abstracts, p. 414, vol. 5, No. 11; p. 439, vol. 5, No. 12.

Peripheral neuritis, p. 115, vol. 5, No. 3.
Phototherapy, p. 312, vol. 5, No. 7; p. 337, vol. 5, No. 8.
Psoriasis, the treatment of, p. 463, vol. 5, No. 12.
Physics applied to medicine, p. 118, vol. 5, No. 3; p. 159, vol. 5, No. 4; p. 203, vol. 5, No. 5; p. 243, vol. 5, No. 6; p. 295, vol. 5, No. 7; p. 317, vol. 5, No. 8; p. 346, vol. 5, No. 9.

Prurigo, p. 468, vol. 5, No. 12.
Publications, p. 273, vol. 5, No. 6; p. 311, vol. 5, No. 7; p. 429, vol. 5, No. 11; p. 470, vol. 5, No. 12.
Palmar psoriasis, p. 43, vol. 5, No. 1.

Reviews and Notices of Books, p. 125, vol. 5, No. 3; p. 401, vol. 5, No. 10; p. 402, vol. 5, No. 10; p. 442, vol. 5, No. 12.
Radiumtherapy, p. 336, vol. 5, No. 8.
Rheumatism, chronic, p. 42, vol. 5, No. 1; in articular, p. 177, vol. 5, No. 4; in muscular, p. 177, vol. 5, No. 4.
Radium, p. 329, vol. 5, No. 8; p. 432, vol. 5, No. 12; p. 207, vol. 5, No. 5; p. 251, vol. 5, No. 6; p. 320, vol. 5, No. 7; p. 336, vol. 5, No. 8; p. 469, vol. 5, No. 12; a few notes on, p. 356, vol. 5, No. 9; interesting case, p. 129, vol. 5, No. 3.
Radiotherapy, p. 334, vol. 5, No. 8.
Rodent ulcer, p. 43, vol. 5, No. 1; p. 47, vol. 5, No. 1; p. 461, vol. 5, No. 12; p. 464, vol. 5, No. 12.
Röntgen rays, p. 251, vol. 5, No. 6; p. 435, vol. 5, No. 12.
Raynaud's disease, p. 341, vol. 5, No. 8.
Radio-active cottonwool, p. 441, vol. 5, No. 12.
Rheumatismal amyotrophy, the treatment of, p. 334, vol. 5, No. 8.
Ringworm, X-rays in the treatment of, p. 336, vol. 5, No. 8.

Smith *v.* Pare, p. 227, vol. 5, No. 6.
Sarcoma, p. 156, vol. 5, No. 4.
Sarcoma, treated with radium, p. 85, vol. 5. No. 2; successful treatment by the X-rays, p. 336, vol. 5, No. 8.
Sciatica, p. 43, vol. 5, No. 1.
Sanatoria, sea-side, p. 149, vol. 5, No. 4.
Surgical instrument makers and X-rays, p. 294, vol. 5, No. 7.
Stomach, fluorescence and transillumination of the, p. 168, vol. 5, No. 4.
Sea bathing, p. 342, vol. 5, No. 8.
Sinusoidal current, the, p. 145, vol. 5, No. 4; triphase, p. 186, vol. 5, No. 5.

Thermotherapy, p, 338, vol. 5, No. 8.
Tinea tonsurans, on the radiotherapy of, p. 414, vol. 5, No. 10.
Tongue, epithelioma of, p. 43, vol. 5, No. 1.
Tracheo-bronchitis, chronic, p. 200, vol. 5, No. 5.

Ultra-violet rays, a screen for, p. 153, vol. 5, No. 4.
Ultra-violet light, p. 206, vol. 5, No. 5.
Unqualified practice, p. 90, vol. 5, No. 2; p. 124, vol. 5, No. 3.
Ultra-violet rays, p. 213, vol. 5, No. 6; p. 458, vol. 5, No. 12.
Uterus, p. 338, vol. 5, No. 8.
Uterine fibroid, the complete absorption of a large, p. 434, vol. 5, No. 12.
Ulcers, chronic, p. 436, vol. 5, No. 12.
Ulcers, p. 468, vol. 5, No. 12.

Varix, treatment of, p. 339, vol. 5, No. 8.

X-rays in the diagnosis of joint conditions, p. 283, vol. 5, No. 7; p. 433, vol. 5, No. 12.
X-rays and surgical instrument makers, p. 294, vol. 5, No. 7.
X-rays as a palliative in the treatment of cancer, p. 122, vol. 5, No. 3.
X-ray and light research, p. 190, vol. 5, No. 5.
X-rays, details concerning, p. 121, vol. 5, No. 3.
X-ray work (Gaiffe), p. 372, vol. 5, No. 10.
X-rays, interesting case, p. 129, vol. 5, No. 3.
X-rays and the Finsen lamp, treatment of lupus by, p. 405, vol. 5, No. 11.
X-rays, expression of needles, etc., after location, p. 81, vol. 5, No. 2.
X-rays in the study of lung diseases, p. 130, vol. 5, No. 3.
X-ray, treatment of cancer of the uterus, p. 122, vol. 5, No. 3.
X-ray diagnosis of endosteal sarcoma, p. 116, vol. 5, No. 3.
X-ray shields, p. 211, vol. 5, No. 5.
X-ray tube, regulation of the, p. 432, vol. 5, No. 12.
X-rays, p. 159, vol. 5, No. 4; p. 336, vol. 5, No. 10; p. 451, vol. 5, No. 12.
X-rays, the treatment of some skin diseases by, p. 450, vol. 5, No. 12.

STON MEDIC...
APR 14 19...
LIBRARY

MEDICAL

Electrology and Radiology.

No. 1. JANUARY, 1904. Vol. V.

This Journal will for the future be published monthly. The change is made chiefly with a view of enabling the reports of the proceedings of the Electrotherapeutic Society to be placed in the hands of members at an earlier date than has hitherto been possible.

Sir Isambard Owen delivered the annual address at the Conversazione of the British Electrotherapeutic Society on Friday, Dec. 18th. It is reported in extenso at p. 29.

Under the auspices of the above Society the Annual Exhibition was opened at 3 p.m. on the 18th ult. In point both of quality and quantity it was a great advance on last year, every maker of note in London being well represented. It seems quite certain that whatever be the status of electrotherapeutics in this country in comparison with others, the instrumentation available is second to none. A detailed report will be found at p. 35.

The announcement of the nomination of Dr. J. Rivière to the Legion of Honour will be welcome not only to confrères in Paris but to friends and patients in every part of the world. Dr. Rivière is widely known as a veritable pioneer and a brilliant exponent of every department of physical therapeutics. On the occasion of his decoration a banquet was given in his honour on Oct. 28th, of which a short report appears at p. 26.

The recent death of Dr. Robert Newman leaves a wide gap in the ranks of contemporary electrotherapeutics. Although not so familiar as are his American colleagues with his social virtues and pleasing personality, we on this side of the Atlantic at least know of the untiring zeal with which he continued his life's work even to the end. If we look around for a monument to perpetuate the memory of his professional labours we find it in his method of the electrolytic treatment of stricture.

1904.

By Dr. W. S. Hedley.

The forecast for the year that is beginning must depend upon a survey of the year that is past. What is the history of 1903? Is it one of progress, of aims accomplished, and of work well done? A triple answer to this question may be found in the transactions of the British Electrotherapeutic Society, in the success of the electrical sub-section of the British Medical Association, and in the efforts of this Journal to report faithfully and comment fearlessly upon all that comes within its scope. These three agencies have separately and together made an honest and successful effort to place medical Electrology, Radiology and Physical Therapeutics upon a proper professional basis; and in the continued absence of effective action on the part of our great teaching centres, they have even had a certain educational rôle thrust upon them, and have thus proved themselves able to supplement the ordinary medical education in several important particulars.

No survey of the year can be complete in this connection without taking into account the educational influence of the foreign press. In electrotherapeutics and its cognate subjects we owe much—more perhaps than it is quite pleasant to admit—to the inspiration and initiative of our confrères abroad; —let us therefore gratefully remember the services of that special literature which keeps us *au courant* with their work, and brings the fruit of their labours home to us in England.

Amongst the assets of the past year there is none more striking nor important than the work that has been done on the physics of Radium, especially in view of the collateral light that has thus been thrown upon some obscure fundamental problems in science. Our ideas of the "ultimate atom" have for some time past been changing, but the study of radium brings us perhaps to the very boundary line where matter ends and force begins. It must be admitted too that radium and its emanations have furnished a happy hunting ground for that little band of pushful persons who, hanging about the outskirts of science, try to steal a little reflected glory from every new thing. They try in some way however remote to identify themselves with the discovery. Their *modus operandi* varies—perhaps they simply write a "preliminary note" just to squat upon the ground, so to speak, and claim priority for evermore. Others of a different class seem to see in radium the key of every mystery, and the worker of every wonder. A writer in the *Nineteenth Century* suggests it as the hitherto undiscovered agency in the Carlsbad cure.

But what do we know of radium, or what do we think we know, at the beginning of 1904?

There are enumerated five radio-active substances—Uranium, Thorium, Polonium, Actinium and Radium. Of these radium is certainly a new substance, although not yet known in the metallic form. As every one is aware Prof. and Mdme. Curie extracted from many tons of uranium residue, obtained from pitchblende, a few decigrammes (two decigrammes per ton) of a product of enormous radio-activity. This was called radium, and was demonstrated to be a simple substance by M. Damarcay by means of spectrum analysis, which showed a spectrum quite different from the spectrum given by any other known elementary substance. The atomic weight has been put down at 225, but this perhaps requires revision.

Radio-activity is expressed in figures, taking that of uranium as unit strength; the radio-activity of radium would thus be represented by 1,000,000 (Curie). In comparison with this the figures for such preparations of radium as have, so far, been used for medical purposes would be 1,000 to 19,000. But a radio-activity of 200,000 or more has been mentioned. (*Jumon, Rev. de Ther.*, Oct. 15th, 1903). Radium bromide is the strongest salt, but this has been produced in such small quantities that, according to one estimate, there is not, or until recently was not, more than about one-eighth of an ounce of it in the world. Indeed it has been said that it is as easy to get gold from sea water (which has, as we know, been done), as to extract radium from pitchblende.*

Radium is constantly giving off an appreciable quantity of heat. It maintains its own temperature at two to three degrees F. above the surrounding air, and this for an indefinite period, without deriving its heat from any apparent source. No satisfactory hypothesis has yet been brought forward to explain the source of heat and other radiations from radium. One theory postulates a transformation of the radium atoms as they are evolved and that this transformation produces heat. A second theory supposes that radium can seize upon and utilise some radiations that are unknown to us.

The emanations from radium resemble Röntgen rays, but differ in some respects. They are divided into three groups.

a. Emanations not affected by an ordinary strong magnetic field, incapable of passing through any but the very

---

*A daily paper is responsible for the statement that the market price of radium bromide of highest efficiency is £3 per milligramme, or £200 per grain; also that a radio-active chl. of Barium can be obtained from carnolite, a common ore found in Utah.

thinnest material obstruction.* Although of very much less penetrating power than the following group they have about 1,000 times greater energy. They make air a conductor and influence a photographic plate. They are the positively electrified atoms. Their mass is enormous in comparison with that of the next group.

β-rays, analogous to Kathode rays, which as we know are now identified with the free electrons projected into space and proceeding from tangible matter; that is to say, these electrons (atoms of electricity) are not undulations of the ether, nor a form of energy, but a substance possessing inertia (probably electric). They are deflected by a magnetic field, have great penetrative power, and are projected from radium with a velocity approximating that of light.†

γ-rays, analogous to Röntgen rays,—vibrations of the ether, produced as we know by the sudden arrest of the electrons, the "Kathode stream," coming into contact with solid matter.

So long ago as 1896 M. Becquerel had shown that uranium gives off constantly rays which act on sensitive plates and pass through opaque bodies. These rays are of course those emitted from all radio-active substances. M. Curie was struck by the resemblance between these "Becquerel rays" and the secondary Röntgen rays emitted by bodies upon which Röntgen rays have impinged. According to M. Sagnac these secondary rays are mixtures of Kathode rays and Röntgen rays.

In penetrative power and action on various screens electrons differ materially from α-rays and Röntgen rays. Whilst the deflectable emanations affect a screen of Barium platino-cyanide strongly, and of zinc-sulph. only slightly, the non-deflectable positive atoms (α-rays) have comparatively little effect on the platino-cyanide, but powerfully affect the zinc-sulph. If a particle of radium nit. be brought to bear upon the latter and the surface be examined by a lens magnifying about 20 diameters, numerous bright scintillations are seen, due probably to the bombardment of the screen by positive atoms projected from the radium. Prof. Crookes calls a little brass instrument thus arranged the "Spinthariscope." ‡

---

* The relative penetrative power of α, β, and γ rays are classed by Rutherford as follows: (Cleaves.)

α	pass	through	a	sheet	of	aluminium	·0005 c.m. in thickness.
β	,,	,,	,,	,,	,,	·05	,, ,,
γ	,,	,,	,,	,,	,,	·8	,, ,,

† But the flight of some of them is retarded by collisions.

‡ Σπινθαρις—a spark or scintillation.

The combined emanations from radium have the power of discharging electrified bodies, a circumstance due to the ionisation of the gas through which they pass; they have photographic and fluorescent effects, an oxidizing action, and the power of converting oxygen into ozone. But the different components of this complex radiation possess these powers in varying degrees. By means of the decomposition of iodoform this oxidizing action is under investigation by Hardy and Wilcox, and it appears that α-rays coagulate electrically-negative colloids, and dissolve positively-charged colloids; β- and γ-rays produce chemical changes and oxidize tissues.*

The most penetrating of the radium emanations are the γ-rays. But Strutt, in a recent communication to the Royal Society † questions the identity of these γ-rays with Röntgen rays. He says that they agree in their power of not conveying an electric charge, in their photographic and screen effects, and in ionising power, but that they differ in their ionising effect on different gases, and it is on this last point of difference (shown markedly, *e.g.* in carbon tetrachloride and methyl iodide) that he bases his doubts.

The power of discharging electrified bodies is an easy test for radio-activity. Rub a stick of sealing wax on flannel, and it is capable of attracting pieces of thin paper, but let the rubbed sealing wax be passed over radium, and this power is lost (London). At the recent Conversazione of the Electrotherapeutic Society a handy electroscope, which consisted of a silk tassel held in the hand suspended by a thread, excited some interest. This tassel on being rubbed by the finger became electrified, and the strands of the tassel separated; but brought into the vicinity of the radium, they slowly fell together. Near an X-ray tube they, of course, collapsed with startling suddenness.

Bearing on this point an instance is given in which radium rays (R.A. not given) took three days to take a radiograph of some instruments in a case, an effect which was easily accomplished by an X-ray tube in three minutes.

The emanations from radium seem to have a bactericidal effect. Aschinas and Caspari (*Prog. Med.*, 1903) state that a three hours' exposure to a radium preparation (strength not given) killed micrococcus prodigiosus. Pfeiffer and Friedberger (*Berl. Klin. Woch.*, July 13th, 1903) state that in the case of cultures of typhosus and cholera bac. exposed at six c.m. from a radium preparation (R.A. not given) the result was negative; but at one c.m. distance there was in plates

* *Engineering*, August 28th, 1903.

† Cleaves.

markedly turbid from bacillary growth, a central bright portion about two c.m. in diameter opposite the radium. At a Conversazione of the Royal Society, May 15th, Mr. Henry Crookes showed plate cultures of several kinds of bacteria which had been exposed to radium emanation through a mica screen. The results proved the "bactericidal effects of electrons from radium." In every case it was found that the organisms were killed in those places where they had been exposed to the action of over 10 milligrammes of radium bromide. On incubation a bare space free from bacterial growth was left on the plate opposite the point where the radium had been placed. The organisms so exposed were bac. liquefaciens, bac. coli commun, and bac. prodigiosus.

Not much is known of the physiological effects of radium emanations. They produce luminous effects upon the closed eye, and this is presumably due to fluorescence of the membranes, or possibly to an action on nerve centres. According to Konigstein (*Sem. Med.*, June 17th) the former explanation is correct. Sachs considers that the luminous effects provoked by radium at the sides or back of the head are perhaps due to the fact that the retina can be excited by rays acting on its posterior surface (*Sem. Med.*, June 17th). Notwithstanding some rather sensational views of the possibilities of radium in the treatment of the blind it is difficult to imagine how non-refrangible radium rays can form images on the retina. It seems also to have been proved clinically in cases of atrophy that these rays do not affect the sensibility of the retina (Holzknecht, *Sem. Med.*, June 17th, 1903). Burns like X-ray burns are produced upon the skin, the muscles being more resistant; but Hallopeau (*Rev. d'El. et Rad.*, Dec., 1902) reports that atonic ulceration lasting five or six months has been produced by too prolonged exposure to radium. Experiments upon the vertebral column of animals show that exposure to these rays may cause paralysis, convulsions or ataxia, and may even be followed by death.

Approaching the question of the therapeutic effects of radium it is evident that these must vary with the R.A. of the salt used, the length and method of its application, the condition of the part, and the distance from the surface treated. Further, there are two obvious methods of using it according to the nature and requirement of the case, (1) short and repeated exposures; (2) prolonged applications producing ulceration. Using an R.A. of 1,900 to 2,500 (Curie) there is, after 36 hours' application, at first no change, or at most a little redness on the skin; but after a period varying from five to 15 days the part assumes a white and macerated appearance, often a blister follows succeeded by ulceration almost as intractable as that after Röntgen rays. The salt being usually put up in a glass tube, the application is often made by simply

holding the tube to the skin ; and it is obvious that it is thus easy to apply it to small or inaccessible cavities. The writer may refer to a case where as a comparative test three patches of lupus on the face were treated respectively by radium, X-ray and Finsen light, the radium being simply held to the skin by the patient himself, and the radium seemed certainly to be the most effective of the three agents in this case. For external use a glass or cellulose bell-shaped cup is sometimes useful, within which the small radium tube is properly secured by wire, an arrangement which also makes it adjustable (Morton). Of course ingenuity will suggest, with so manageable a material, an infinity of methods of application. For the eye ointments would be available, or sub-conjunctival injection, (Darier) or a similar solution for administration by the stomach (ulcer cancer), also suppository, inhalation, &c. For external application a sort of plaster consisting of the salt of various activities sandwiched between mica plates. Its costliness is of course against the employment of radium, but the optimist may see a means of getting over this in the fact that radium has the power of transferring a portion of its activity to certain metals brought into its proximity.

As to the theory of its action, Exner and Holzknecht consider that "radium rays irritate the cells of the strata of the skin less vehemently than they irritate the cells of cancer and sarcoma The latter are brought to necrosis before the other tissues suffer severely from the effects."

Speaking broadly (and loosely) radium has frequently been used in lupus (with cure), in psoriasis occasionally, in epithelioma of the orbit, in orbital neuralgia and acute iritis, with relief of pain, in rodent ulcer and superficial malignant disease with apparent disappearance of the growth, in cancer of the breast with relief of pain.

Scattered through the pages of current literature there are a fair number of "cases" to be found, but the number of these that combine the essentials, of accurate details of treatment and definite result is phenomenally small. The following are within the knowledge of the present writer, but it cannot be said that they all fulfil the test conditions required :—

(1) A case of lupus of the face treated by M. Danlos with an R.A. of 19,000. The total exposure was 36 hours ; a smooth white cicatrix followed (*Rev. d'Elect. et Rad.*, Dec., 1902.) Treatment was commenced with a mixture of chloride of barium and chloride of radium in rubber or celluloid bags four or five centimetres square, but the active surface was only 15 by 25 millimetres. This arrangement was given up, partly on account of the difficulty of maintaining asepsis in the rubber, and partly because the radiations were propagated to the detriment of neighbouring organs, *e.g.* the

eye. The radio-active substance was then enclosed in wood, covered by lead, with an aperture on one aspect so as to limit the action of the radium.

(2) Several cases of lupus are described by Dr. Blandamour in which the exposure was 24 to 40 hours with an R.A. of 5,000 to 19,000. (*Sem. Med.*, Jan., 1903.)

(3) Lupus of hand, treated by Dr. MacIntyre with "radium rays" for twenty minutes every day for three weeks,—disappearance of disease. (*Adv. Ther.*, Dec., 1903.)

(4) Lupus of nose. (Dr. MacIntyre) treated for four weeks. Result as in last case.

(5) Psoriasis, back of hand, duration 12 years, area two inches in diameter. A tube containing one gramme radium and barium, R.A. 1,500. Tube held in a stand one inch from diseased area. Improvement at end of two weeks. (*Adv. Ther.*, Dec.)

(6) Melanosarcoma of the left humerus. Had been operated on three years previously; for the past eight months had noticed several small subcutaneous dark coloured nodules near the seat of original disease. First seen, February, 1903, at the late Prof. Gassenbauer's clinic; microscopical examination proved it to be melanosarcoma. A small capsule of vulcanised indiarubber, one side of which was replaced by mica, fixed to skin by means of bands of plaster, exposure from five to 25 minutes. No metastatic nodule exposed more than once. Between two and 48 hours after exposure to the radium dermatitis ensued. At the end of 14 days this had disappeared. In spots, when the exposure had lasted less than a quarter of an hour there was no change whatever, the dermatitis having disappeared, but in those where the exposure had lasted 15 to 25 minutes a number of metastatic nodules had diminished or disappeared. Other nodules also appeared on the shoulder breast and left humerus. In a month all nodules had disappeared,—their place being only revealed by a depressed cicatrix (cases shown by Exner and Holzknecht, Med. Soc., Vienna, June 26th, 1903).

(7) Melanosarcoma, another case with metastasis of the skin;—same result (also shown by the above-named on the same occasion).

(8) Carcinoma mucosæ oris. Operated on about 16 years ago, and again about 11 years ago, and again five years ago. When seen on May 11th, 1903, condition as follows: On upper and lower lips and corner of mouth right side, there was an ulcer the size of a shilling, and a hard tumour the size of a small nut was found to be extending into the surrounding tissues. Microscopical examination proved carcinoma of epithelial type. Another similar tumour on left of palate. First tumour exposed to radium on August 11th, and on six occasions afterwards, each spot being treated from 15 to 25

minutes. 17 days after first exposure ulcer healthy and nodule disappeared within the next 12 days, no trace being found when shown on June 26th. Later, however, it appears that malignant cells had remained in the deeper tissues, the patient was again attacked by cancer and, after a few months, died. (Exner and Holzknecht, Med. Soc., Vienna, June 26th, 1903).

(9) Epithelioma, left cheek, size of sixpenny piece, margin hard and raised, centre depressed. Capsules containing radium applied. After three days the margin had become level with the centre. Two further applications of five minutes each were necessary for disappearance of disease. Patient did not again present himself for treatment, therefore subsequent history unknown. (Holzknecht, Med. Soc., Vienna, June 26th, 1903.)

(10) Sarcoma, involving buccinator region and mucous membrane of lower left maxillary region. Treated with chloride of radium and barium. R.A. 7,000. Pain almost completely controlled, induration softer, improvement in mobility and appearance of ulcer. Afterwards relapse in the latter, and, the radium being no longer available, reverted to X-ray. (Dr. M. Cleaves, Am. Elect. Assoc., Sept. 1903.)

(11) Malignant ulceration involving cervix uteri. Symptomatic improvement. (Ref. as in last case.)

(12) Epithelioma recurrent. Rodent ulcer type; treatment just commenced. (Ref. as case 10.)

(13) Malignant disease of breast, recurrent, with return of stabbing pain in breast and axilla. Pain controlled from the first. (Ref. as case 10.)

(14) Epithelioma of neck, one and a half by two and a half inches, and elevated a quarter to half an inch above surrounding parts, edge indurated, surface covered with crusts. A tube of radium (10 milligrammes), R.A. 300,000, fixed in tube holder about one inch distant from the part; exposures from 15 to 20 minutes three times a week. After a week's treatment growth softer, with tendency to slough. "Cure expected." (Dr. Tracy, *Adv. Ther.*, December, 1903).

Without doubting the therapeutic future of radium, and without imagining that the few cases here referred to represent anything like the whole of the work that has been done, it must nevertheless be apparent that we have not advanced far on the road to success in radium therapeutics. At the same time there can be no reasonable doubt that such superficial diseases as lupus and certain cutaneous affections, as well as rodent ulcer, can be successfully treated by radium. Further, that there is some probability that in the future other forms of malignant disease may yield to more powerful preparations and better methods. But actual demonstration of the latter is still lacking.

It is to be hoped that there will soon be forthcoming a series of clinical cases carefully diagnosed and exclusively treated by radium salts of given R.A., under definite experimental conditions.

In the meantime it is necessary to keep an open mind. 1903 has not witnessed more than the humble beginning of radium therapeutics. But who can say that the end of 1904 may not have a very different tale to tell?

(To be continued).

PRACTICAL LESSONS IN THE TREATMENT OF AFFECTIONS OF THE GASTRO-INTESTINAL TRACT, BY ELECTRICAL METHODS.

By GEORGE HERSCHELL, M.D., London.

I may premise by saying that these papers are not intended for the expert, but are written for the now rapidly increasing number of medical men who have become interested in the subject and who, appreciating the value of electricity, wish to make use of it in their daily work. These short articles will therefore be of an extremely elementary character, their aim being not to exhaust the subject but merely to supply plain and straightforward directions for the treatment of some of the commoner disorders of the digestive system. For a like reason only apparatus will be described well within the reach of the general practitioner who cannot reasonably be expected to expend a necessarily large sum in the purchase of a high frequency group or a static machine, when in all probability a comparatively small number of his patients will need electrical treatment in the course of a year. For the consolation of such I think that it may be stated without fear of contradiction that, notwithstanding the assertions of interested or too enthusiastic persons, it has not yet been definitely proved that the electrical forms of energy of high potential and frequency will accomplish anything more than the older electrical modalities with which we are well acquainted. It is, moreover, quite certain that they are much more dangerous in unskilled hands. When we take into consideration the fatal effects of a high frequency current on the smaller animals, we have brought home to us the insensate folly of allowing such powerful agents to be administered by nurses, so-called medical electricians, or, in fact, any but properly qualified medical men. With the galvanic, the faradic, the galvano-faradic and sinusoidal currents we can practically do for our patients everything that electricity is capable of. By the currents of high frequency and potential

we can certainly increase the metabolism of the body. That has been proved experimentally. But we can as certainly duplicate the effect by means of the sinusoidal bath or by the triphase alternating current, and in a lesser degree by general faradisation. As the discussion of the elementary facts of electricity will not come within the scope of these papers, it is assumed that the reader has already made himself acquainted with them by perusing one of the several admirable elementary books treating of medical electricity.

For the successful treatment of disease by any agent it is essential that the practitioner should have first of all—

(*a*) A definite idea of the exact effects produced by that agent.

(*b*) A knowledge of the precise technique necessary to invariably secure these effects.

(*c*) And a definite understanding of the effect he wishes to produce in the case before him.

Under these circumstances, and these only, can he hope to produce any good results.

It is the lack of such knowledge that causes the use of electricity by unqualified persons to so materially retard the progress of scientific therapeutics.

In the hands of a man who knows exactly what he can do with it, and also what is required to be done in the disease he is treating, electricity is a weapon of precision, otherwise disappointment is certain.

In the disorders of the digestive system electricity is capable of producing the following results, when applied by certain definite methods :—

(1) It can cure forms of neurasthenia depending upon defective metabolism, and in consequence some functional dyspepsias associated with it.

(2) It will diminish the secretion of hydrochloric acid in the gastric juice when in excess.

(3) It will diminish hyperæthesia of the gastric mucous membrane.

(4) It will promptly cure certain forms of gastralgia and epigastralgia.

(5) Slight degrees of gastric myasthenia can be absolutely cured and the severe form usually much improved ; that is to say, retention myasthenia can be often converted into myasthenia without retained food débris.

(6) In certain cases of functional hypochylia and anachlorhydria, the secretion of gastric juice can be re-established.

(7) Constipation depending upon intestinal atony can in most cases be either materially relieved or cured.

As far as our present knowledge goes this is all we can do. We cannot magically cure "indigestion" by "elec-

tricity" as the advertisements of the various light cure and electrical institutions would have us believe; but when we wish to produce any of these effects in any particular case we can do so, *if we know how.* I therefore propose to take these several conditions in order, and attempt to set forth as well as I am able, what appears to me according to my personal experience, to be the correct technique for producing the results desired in each case.

(*To be continued.*)

A BULLET LODGED IN THE HEART WALL.

By EDWARD W. H. SHENTON., M.R.C.S.

It would be unwise to lay too much stress upon the subsequent historic notes of the case of Max Meyer, the German, who is at once the most unfortunate and fortunate of men. Having been shot in the heart two-and-a-half years ago, he is at the present time in excellent health. The notes, for a translation of which I have to thank Mr. Sydney Jacobson, M.D., are unauthenticated—with which preliminary warning an abstract follows.

Max Meyer, aged 22, on the evening of June 27th, 1901, received an 8 m.m. revolver bullet in his left breast, the weapon being but two metres distant. Shortly afterwards he was able to stand up and walk, but later losing consciousness, he was conveyed to the clinique of Professor Trendelenburg at Leipsic. It is stated that he remained unconscious for three days. On admission his pulse was five or six to the minute, rising to 18 per minute by the 2nd of July, three weeks after the injury. He was examined with the X-rays on admission, but without result. Hæmoptysis, cough, and pains in the chest persisted for two weeks.

It is here mentioned that two weeks after the injury the pulse was 24 per minute, which statement is contradictory on the face of it to the preceding. Fever is recorded from the 29th of June to the 20th July. He was examined with the X-rays upon the latter date, and the bullet located. On November 2nd he was allowed to get up and gradually regained strength, his pulse varying from 10 to 40 per minute. On November 2nd his pulse becoming intermittent he was ordered to bed. Early in February his pulse was normal. He was examined by the X-rays daily from this date to September 1st, 1902, and was then discharged. He fainted November 3rd, 1902, having noticed for several days previously that his pulse rate was falling, until on that day it was 13 to the minute.

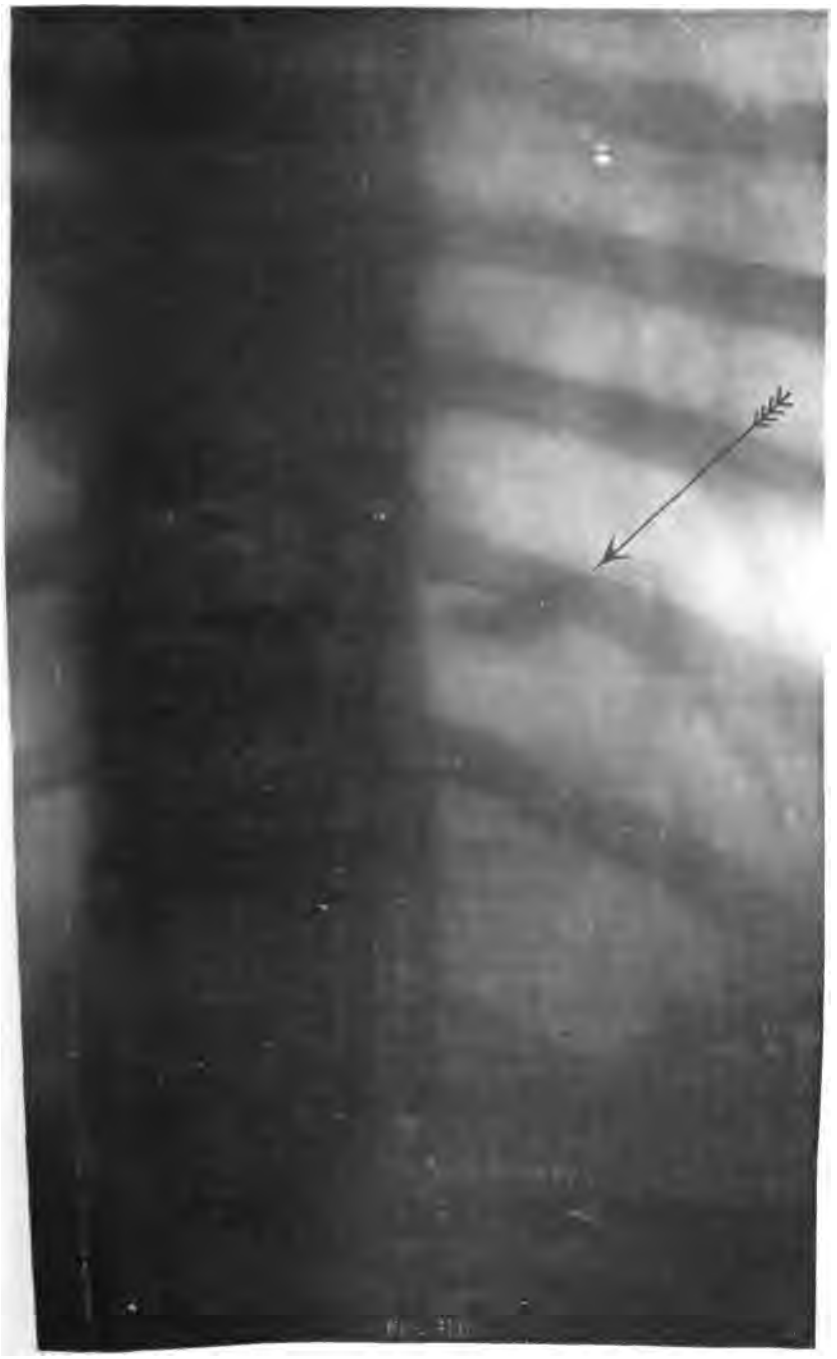


Fig. III.
Viewed from behind. Exposure 20 seconds.
Taken while patient held his breath.

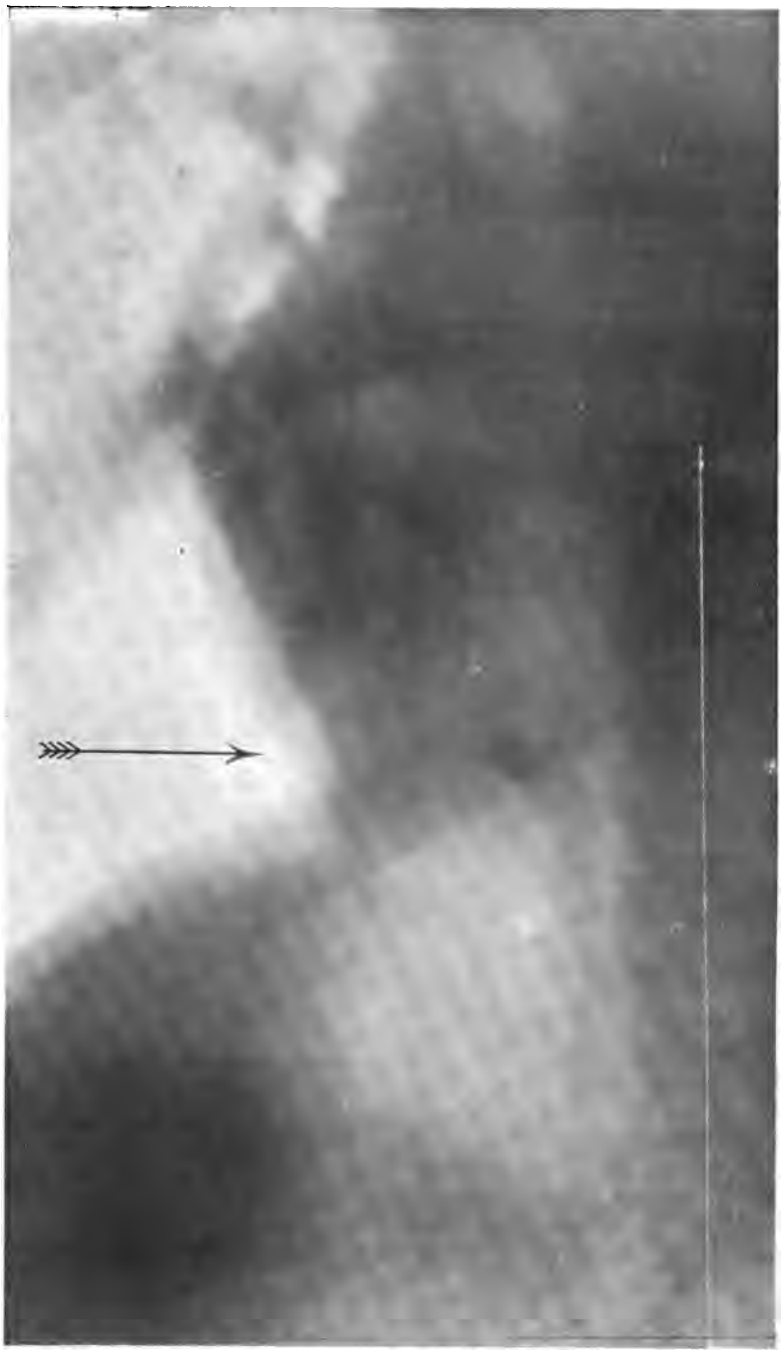


Fig. 11.

Viewed from in front. Exposure 20 seconds.
Taken while patient held his breath.

Since then, *i.e.* for over a year, he seems to have suffered no inconvenience, save when he runs fast, bends forwards, or lifts heavy weights, when he experiences pain in the chest.

This concludes the summary of the notes, the most interesting features of which are the extraordinary pulse records and the fact that at such an up-to-date clinique as that of Professor Trendelenburg the bullet was undiscovered at the first X-ray examination. A margin must, however, be left for possible inaccuracies.

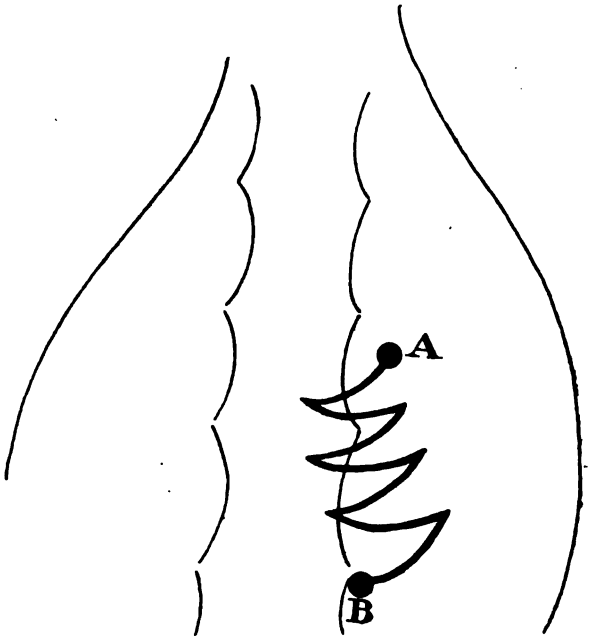


Fig. I.

The patient is an exceptionally well-built young man, and but for the scar on his left breast would attract no interest medically. The back and chest are bronzed—the back considerably—by the action, I believe, of the X-rays. Two light patches of uncoloured skin upon his back indicate where some protection to the rays was afforded by some application, such as a plaster.

Upon examination with the screen the bullet may be seen showing through the spine, but slight lateral deviation of the rays shows the bullet clearly against the more transparent lung. The fact of the bullet moving synchronously with the left ventricle, the margin of which is so easily seen with the rays, suggests its presence in the interior or wall of a

ventricle. Its position being more to the right indicates the right ventricle, and the smallness of the bullet shadow when seen from behind means that it is nearer the back of the chest than the front. The absence of bruits and other heart symptoms, the regularly placed and unvarying excursions, suggest a bullet in muscle rather than free in the heart cavity. It therefore seems probable, from a consideration of these facts, that the bullet lies encysted in the posterior wall of the right ventricle.

The accompanying skiagrams are of mere passing value compared with the screen examination, for in the latter it is clearly seen what curious excursions the piece of lead makes, influenced by heart and respiratory movements. The first impression is as if some small live creature were being viewed hopping unceasingly from one spot to another. Careful observation shows the movement to consist of a jump from side to side, the path taken being represented by a line convex downwards.

The field of this horizontal movement moves vertically with the rise and fall of the diaphragm. I have endeavoured to indicate the bullet's path on the accompanying plan (Fig. 1). Roughly speaking the distance between the bullet's highest and lowest points is one-third of the breadth of the heart shadow. The extreme sideway variation is nearly half this. Perhaps the most instructive feature is the large vertical distance traversed by the bullet, confirming, as it unquestionably does, that the heart itself rises and falls considerably with the diaphragm excursions. It is incorrect to say that this case is unique, but since the advent of the X-rays nothing has been seen of such an unusual nature as a bullet lodged in the heart with but slight inconvenience to the recipient.

I have to thank Mr. Read and Dr. Chaworth Lyster for an opportunity of seeing this patient.

American Electro-Medical Society.

On December 1st, 2nd and 3rd, 1903, the annual meeting of this new organization will be held at the Masonic Temple, Chicago, Illinois. This Society, with over 150 members, has for its object—"Investigation in Electricity and Allied Sciences, and the encouragement of their application to Medicine and Surgery by the formation of District and Local Societies."

PROCEEDINGS OF THE AMERICAN ELECTROTHERAPEUTIC ASSOCIATION.

THIRTEENTH ANNUAL MEETING, held in Atlantic City, New Jersey, September 22, 23 and 24, 1903, DANIEL R. BROWN, M.D., of Chicago, President.

The Association convened in the Hotel Windsor, September 22, at 9 a.m.

The deliberations of the Association were saddened from the beginning by the death of one of the most widely known and indefatigable workers in the organization, and at the same time one of the founder members, Dr. Robert Newman, who was called away August 28th, 1903, while busily engaged in making the final arrangements for the meeting as chairman of the executive committee.

In the presentation of the usual formal resolutions, their spontaneity and genuineness were evidenced by the expressions of deep and sincere feeling on every hand. The President, Dr. DANIEL R. BROWN, in his address, voiced the sorrow of the Association in its loss. The wide-spreading interest and advancement of scientific electrotherapeutics was considered by the President, who suggested that the Association should unite with the American Medical Association, or become one of the component societies of the Congress of American Physicians and Surgeons. Such a step would offer an excellent opportunity for interesting the general practitioner in electrotherapeutics, and advances had been made by the President of the American Medical Association to that end. He also suggested that the time had come when the terms galvanism, faradism, and franklinism should be dropped from our nomenclature, and that the scientific technical terms should be substituted in their stead. Drs. C. F. Skinmer, F. B. Bishop and F. H. Morse were appointed a committee to consider the recommendations in the President's address.

Prior to the address of the President, the Association was warmly welcomed to Atlantic City by the Mayor, Hon. Franklin P. Stoy, who extended to the Association the freedom of the city. Dr. Blair Stewart, chairman of the committee of arrangements, also warmly welcomed the Association, and reported at length the arrangements made for its comfort and pleasure in conjunction with Dr. Newman.

Dr. BYRON C. PENNINGTON, on behalf of the Atlantic City Academy of Medicine, welcomed the Association on behalf of the profession. In his remarks he said that 15 or 20 years ago, when Apostoli was making such extraordinary claims for the curative power of the current, he (the speaker), like many others, interested himself in this work. After three or four years he gave it up, but he must admit that we are all reaching out for something more curative than

drugs, and he believed that by long odds electrotherapy heads the list of the promising curative agents. Advances in this field have been many and important, and it is now more a science than the fad it used to be.

To this Dr. W. J. HERDMAN responded, saying there was hope even for a back-slider in electrotherapeutics, if he will only attend our meetings faithfully. I think we can assure him that by means of properly equipped and properly handled electrotherapeutic appliances in his office he will be able to do a great deal.

Reports were made by the following standing committee: On "Electrodes," by Mr. R. G. BROWN; on "Constant Current Generators and Controllers," by Dr. W. J. HERDMAN; on "Cataphoresis," by Dr. F. B. BISHOP; and on "Current Classification and Nomenclature," by Mr. W. J. JENKS.

The report of the last-named committee was of the greatest practical interest and value. The term "galvanic current" should never be used, and so far as possible the term "constant current" should take its place. The "faradic current" should always be referred to as an induced current or, better still, as the magnetic induced current. The committee had sent their preliminary report of a year ago to many electrical engineers, inviting their criticism, but up to the present time practically no criticisms had been received, thus indicating that the committee's suggestions regarding nomenclature had met with very general approval. Diagrams were presented representing combinations of primary static generators and secondary or modifying apparatus used by physicians. The intelligent classification of these, they found, must be based primarily upon the curves which properly represented the resulting currents. The actual experimental work was done by Prof. SAMUEL SHELDON, of the Brooklyn Polytechnic Institute, whose observations and conclusions were given in detail. Prof. Sheldon, working with the well-known make of static machines, a Holtz, found that when this machine was running at 315 revolutions per minute, without excitation, it consumed 106 watts, and that the loss due to friction was 30 watts or $\frac{1}{25}$ of a horse-power. After exciting the machine, the total power consumed was 184 watts, or about $\frac{1}{4}$ of a horse-power. To the surprise of the committee it was found that the machine, under certain conditions, would deliver 27 per cent. of the energy put into it by the motor. If the machine were operated with its discharging rods in contact the current should be directly proportional to the speed. While the discharging rods were in contact there was very little difference in the parts of the machine situated between the collecting combs. Three different kinds of current from these machines were described, viz., (1) the current taken from the discharging rods, the latter being

separated ; (2) the current taken from the outer coating of Leyden jars, whose inner coatings were connected with the separated discharging rods ; and (3) the current taken from a coil of wire connected with the outer coatings of the Leyden jars, whose inner coatings were connected with the separated discharging rods. A condenser of large capacity would tend to produce relatively slow oscillations. The electrical engineer could determine in advance the result that would be obtained by the introduction of such modifying devices, but when living human tissue was interposed an absolutely unknown factor was introduced as regards its effect upon currents of alternating character and high pressure. The physically active section of the external circuit must, therefore, be investigated before one can determine the curves of the currents employed. The various currents employed in therapeutics were then described in detail and illustrated by diagrams.

Dr. ALFRED W. BAYLISS, of Buffalo, presented a paper on electrotherapy as a specialty in which he dwelt upon the need for special preparation. He also advised the exercise of caution in giving a prognosis until the effect of the current had been studied in the individual case. In the discussion both Drs. A. W. ROCKWELL and W. B. GREEN objected to making electrotherapeutics a specialty.

Dr. BOARDMAN REED, of Philadelphia, in *The Effects of Secondary Static Currents in Removing Albumin and Casts from the Urine*, stated that probably one-fourth of his cases of gastro-intestinal disease of long standing had had hyaline casts and albumin in the urine. They had, nevertheless, proved amenable to dietetic and other treatment. They probably belonged to the category of toxic nephritis and resulted from the toxins of indigestion upon the kidneys. He proposed calling such conditions autotoxic nephritis, and believed that if neglected or wrongly treated they might lead to permanent organic disease of the kidney. His experience in treating these conditions had not been satisfactory until he had resorted to the use of static electricity as suggested by Dr. A. W. Rockwell. Eighteen cases of this kind had been treated in the past year. Four illustrative cases were reported, in three of which static electricity had successfully controlled the albuminuria. In his experience the magnetic induced current had not proved so useful in this condition as the static current. He had used the static wave current, but was inclined to believe now that the static induced current was the best form to use. Urine analyses were made both before and after treatment and showed a decided increase in the amount of urea.

In discussion, Dr. A. W. ROCKWELL said that he believed by establishing circulatory drainage much could be done in the way of relieving inflammatory action in the tubules and

stroma of the kidney, a condition often spoken of as Bright's disease. No sharp line of demarcation seemed to exist between inflammatory and structural disease of the kidney. Electricity was useful in reducing congestion and increasing blood pressure in the glomeruli of the kidney, and in this way it improved the nutrition of that organ, and theoretically at least freed the glomeruli from the products of inflammation. The speaker cautioned against too much optimism in the treatment of such cases, for it had taken him five years to secure five cases which, in his opinion, were suitable for electrical treatment. Duration of treatment in such cases had been from three to 18 months, and in each instance he had taken the precaution to have the accuracy of the clinical records vouched for by medical colleagues. He was firmly of the opinion that the method was of value in the milder forms of kidney disease.

Dr. W. B. SNOW, of New York, in expressing his surprise that Dr. Reed preferred the static induced current to the static wave current, was disposed to believe that this was due to the writer having used too small a spark gap. He believed that less good results would accrue from the use of the static induced than with the static wave, because the former was more local in its action than the latter, and produced less nutritional effect. With the electrode contact to the back, in using the static wave current, he employed a spark gap of from 4 to 6 inches, and in some persons a gap of even 8 inches was used.

Dr. G. BETTEN MASSEY reported that he had had diminution of sugar in a case treated some years ago, under the use of static electricity. Case improved but was not cured.

Dr. REED concluded by saying that possibly if he had a more powerful machine he would have secured better results from the wave current. He wished it distinctly understood that he did not claim that any of his cases had been cured, but simply that after treatment of from one to three months the urine became free from albumin and casts, and that this apparent cure had lasted so long as these persons had observed a proper mode of life.

Dr. A. W. ROCKWELL presented a paper upon "Some Principles on Which is Based the Therapeutics of Electricity in Nervous Diseases," stating that physical methods, combined with climate and diet, are beginning to be regarded as the essentials, not only in the cure but in the prevention of many diseases. Disappointments in the results obtained from the use of physical methods of treatment, especially electricity, in those cases where, according to well established principles, the treatment ought to be efficacious the writer found to be, (1) ignorance of the physics and physiology of the method

employed; (2) imperfect technique; (3) failure to appreciate the differential indications for the use of the various modalities. The author also presented some theoretical considerations concerning the manner in which electricity acts on the nerves, and discussed the possible identity of electricity and nerve force.

"X-ray and Light in the Treatment of Tuberculosis" was considered in a paper by Dr. RUSSELL H. BOGGS, of Pittsburg. In the writer's opinion these two therapeutic methods should be placed first among the adjuvant measures in the treatment of this intractable disease, and that too without regard to its location.

For the purpose of exciting his X-ray tubes, he objected to the static machine because of its uncertainty and lack of volume. He made use of a medium low tube, excited by sufficient current to penetrate the chest. All tubes did not work equally well when used with the same spark gap, and he found it necessary to keep 10 or more tubes in hand having individual qualities. Exposures were made for 10 minutes on alternate days. All other measures known to be of value should be employed.

In discussion, Dr. DICKSON queried whether Dr. Boggs had used the static machine, as his results with this machine he believed to be fairly good. Dr. Snow said that if the static machine were used in such a way as to obtain a sufficient volume of X-rays, the results from their use so generated would be equal in every respect to those obtained with the coil. How could he accept the statement that the fluoroscope was a better index of the quality of the X-ray tube than the spark gap?

Dr. ROBERT REYBURN, of Washington, D.C., said that there could be no question but that some of these cases were cured by the X-ray, and he had come to the conclusion that both in tuberculosis and in cancer the X-ray surrounded the morbid cells with an inflammatory product, thus preventing systemic infection. The nutrition of the part was also increased, so that when aided by proper diet and hygiene this agent was enabled to overcome the tubercle bacillus and produce a cure.

Dr. T. A. PEASE, of Norwood, N.J., reported in this connection a case of extensive tuberculous involvement of the glands of the neck that he had cured by static electricity.

Dr. F. B. BISHOP, of Washington, D.C., believed with Dr. Boggs that the coil as a rule yielded better results. To secure as good results with the static machine, a powerful machine operated at high speed and with a high vacuum tube was necessary. For superficial growths the static machine gave as good, if not better, results, because there was less danger of burning the patient and less liability of breaking

the tubes. It was not possible to get the same volume of current through the tubes with the static machine as with the coil.

He was satisfied that he had cured three cases of tuberculosis by means of the connective discharge from "a cage," to the wires of which were attached numerous bunches of fine wire affording many points of discharge within which the patient was placed.

Dr. E. L. TRUDEAN was authority for the statement that the apex of the left lung in one of these patients, which had been the seat of an active tuberculous process at the time of coming under cure, had healed.

Dr. GEORGE S. GOODELL, of Salem, Mass., stated that he had been treating for the past three months a young girl of tuberculous history, employing a tube excited by a coil and a spark gap of three inches, but without any diminution in the size of the nodes.

Dr. WILLIS P. SPRING, of Minneapolis, Minn., inferred from the superiority of the coil in X-ray photography, that it was better than the static machine for X-ray therapeutic work, instancing as corroborative of his belief his failure to locate a suspected fracture of a metacarpal bone with the static machine, but which was distinctly shown when the tube was used with a coil in taking a radiograph.

Dr. BOGGS in closing said that he did not wish to be understood that good work could not be done with a static machine, but that it was much more difficult. The distressing cough in many of his cases had been quickly relieved for a period of several hours by the light treatment.

(To be continued).

BANQUET RIVIÈRE.

A banquet was given on October 28th to Dr. J. Rivière on the occasion of his nomination to the Legion of Honour. It was presided over by M. Deputy Brunet. The assembly quite filled the great hall of the Palais d'Orsay. Amongst those present were Prof. Lancereaux, President of the Academy of Medicine; Dr. Philippeau, President of the Medical Society of the Seine, and a number of foreign medical men, amongst whom was the Hon. Dr. Herbert, Physician to the British Embassy. Letters of regret were read from Dr. d'Arsonval, Vicomte de Vogüe, Professors Landouzy, Raymond, Albert Robin, Pozzy, Duguet and M. Mormier.

The President concluded a magnificent address as follows:—

" . . . La haute distinction qui a reçue le Docteur Rivière est certes bien méritée.

" Poursuivez votre œuvre, vous, qui dans un effort continu et jamais lassé, avez su discipliner les agents physiques et appliquer

les forces de la nature à l'allégement et à la guérison des souffrances humaines.

"Je bois, Messieurs, au Docteur Rivière, au savant modeste, à l'homme d'avant-garde qu'illumine l'esprit d'ardente et libre recherche, dont la vie et dont l'œuvre sont un hommage à la science fondée sur la conscience, car vous n'avez pas oublié, mon cher ami, la forte parole de Montaigne : 'Science sans conscience n'est que ruine de l'âme.'" (Prolonged applause.)

Prof. Lancereaux, who was received with a tremendous ovation, spoke as follows :—

"Je suis véritablement confus des louanges qui viennent de m'être prodiguées et que je dois à la bienveillance et à l'amitié de notre Confrère qui m'a vu vraiment avec des verres par trop grossissants. Aussi suis-je très heureux de constater une fois de plus que l'amitié qu'il sait donner lui est largement rendue. La brillante réunion qui en ce jour vient le féliciter, en est une preuve saisissante.

"Permettez-moi donc, cher ami, de me joindre à tous ceux qui sont ici présents pour adresser à l'un des principaux auteurs de la Physico-Thérapie, cette branche nouvelle et si importante de la Thérapeutique, mes félicitations les plus sincères pour une récompense si juste et si bien méritée.

"Levons donc tous nos verres en l'honneur du savant et aimable Docteur Rivière."

Addresses were also delivered by Dr. Mazery, M. Edgar Gallet, Drs. B. Berillon, Cogrel, Foveau de Courmelles and Besançon, the latter concluding as follows : —

"Si je disais que Rivière a inventé l'électricité et la façon médicale de s'en servir, il ne pardonnerait pas cet excès à mon amitié. Notre ami est un modeste, et s'il tient sa place dans la bonne équipe des électriciens français, il est le premier à reconnaître le mérite de ses confrères, au premier rang desquels il me plaît de citer ce bénédictin de la science électrique qui s'appelle Foveau de Courmelles . . . Mais ce que je dois dire c'est que Rivière est le créateur du plus extraordinaire établissement de physico-thérapie qui soit, non seulement en France, mais dans le monde entier, que cet établissement a été le premier en date comme il est le premier en beauté, — qu'il fait l'admiration des médecins étrangers et des médecins français qui usent journellement de la gracieuseté de notre confrère pour visiter ses appareils, — que la notoriété n'en est due qu'à de nombreuses et méritantes publications scientifiques, — et que c'est à cette œuvre, et la discrétion dont fut entourée sa création, que le gouvernement de la République, malgré qu'on se soit efforcé de l'en empêcher, a voulu donner une récompense en faisant le légionnaire que nous fêtons aujourd'hui.

"Messieurs, je bois à mon ami Rivière !"

PART II.

THE BRITISH ELECTROTHERAPEUTIC SOCIETY.

The Annual Conversazione of the Society was held on Friday, Dec. 18th, at 11, Chandos Street. The address was delivered by Sir ISAMBARD OWEN, who said :—

Mr. PRESIDENT AND GENTLEMEN,—I have first to thank you for the compliment you have paid me in inviting me to address you this evening. Next I have the pleasant task to perform of congratulating you upon the success that has attended your efforts to establish this Society and place it on a substantial basis. I learned of its foundation with much interest and satisfaction. It is in my opinion a Society that was greatly needed, and one that has in its power to render important service to the cause of scientific medicine. The treatment of disease by physical methods, and in particular the application of recently discovered forms of physical energy to this purpose, has been pushed forward of late years with such enthusiasm, and such remarkable claims have been made in its behalf, that the profession at large is greatly in need of sober guidance and of a source of authoritative information in the matter. In the face of the eager expectation and extravagant promise that certain of the most recent developments of physical therapeutics have in many quarters evoked, it is very desirable that those members of our profession who are in a position to undertake a really scientific investigation of the value of the new methods should draw together both to assert their position in the eyes of their professional brethren, and by union of effort to strengthen the cause of serious and critical enquiry into the matter. May I take it as an earnest of the critical spirit in which the Association is approaching its task that you have invited to this desk to-night, not a professed specialist in electrotherapeutics or neural pathology, but a general physician whose field of work obliges him to take a comprehensive view of such a matter, and whose personal reputation is, if anything, that of being somewhat unduly sceptical in his estimates of therapeutic results.

Your Society will, I think, need an ample measure of the critical—may I say even of the sceptical—spirit in its self-imposed task of dealing with some of the physico-therapeutic questions that are now agitating the medical world, for the atmosphere in which your work will have to be done is one that may best be described as oppositely charged. The many unexpected revelations which physical science has yielded during the last 20 or 30 years have prepared the public

mind for the anticipation of physical marvels, and whetted its appetite for new things. The report of each new departure in physical treatment falls nowadays on eager ears, both within and without the medical profession. As each fresh discovery in the realm of pure physics is followed by its application to medical treatment the news is speedily flashed across Europe, and whatever region it reaches it is sure to find there an expectant body of adventurous spirits eager to devote themselves to working the new field of therapeutic enterprise opened to them. Our therapeutic pioneers for the most part, let me frankly grant, are genuine and honest enthusiasts; but a large element among them is none the less, if one may judge from its published utterances, as little fitted to deal with a question of scientific therapeutics as the followers of Walter the Penniless were to undertake the siege of Jerusalem. To complicate the situation further, these questions are not always left entirely in the hands of members of our own profession. The movements of the regular troops are perturbed by those of the camp-followers, who are claiming to take a place in the fighting line. Members of various occupations remotely connected with medicine, ignorant alike of pathology and diagnosis, affect to take an active share in directing medical treatment, and find their pretension admitted seemingly on the paradoxical ground that their sole armamentarium is a piece of powerful physical apparatus, wielding forces as yet but imperfectedly measured or understood.

Need we be surprised under the circumstances at the premature tales of wonder that occasionally reach our ears, or at the roseate hues in which we find the future of terrestrial medicine painted? "*Redeunt Saturnia regna.*" The age of miracles is to be restored. Cancer is to be reft of its sting, gout and rheumatism to cease from troubling, the tuberculous are to be healed, the osteoarthritic to rise up and walk; all that is needed is for the sufferers to place themselves, like Rider Haggard's "She," in the path of the latest discovered form of radiant energy. The art of medicine is reduced to a degree of simplicity that Sangrado himself could scarce have improved on.

To sift in such cases the grains of sober fact from the chaff in which they are buried is, I understand, a part of the work which your Society has proposed to itself, and all honour to you for undertaking it. Difficult and even invidious as the task must needs be, it is one of urgent necessity; for unless the two are separated a wind threatens ere long to arise that will carry both wheat and chaff indiscriminately away. To a period of exaggerated expectations one of equally groundless distrust must inevitably succeed. The popular idol whose day of unmerited favour is past is

liable to become the victim of equally needless opprobrium, and it may be long before a hearing can be obtained for a calm and impartial judgment. It is to your Society and to societies of like aim that we shall have to look to save the solid work that is being done in these matters from discredit, and to incorporate it finally in the growing fabric of accepted medicine.

No philosopher, as far as I know, has ever yet thought of making enquiry into that most suggestive subject, the psychology of therapeutic belief and therapeutic error. Few philosophers, it is true, have the necessary experience of medical practice, and few practising medical men have the necessary leisure for philosophic meditation. Were a philosopher with the requisite experience of medicine to arise I should incontinently urge him to render his profession this service. The results, I feel sure, would be of practical no less than of theoretical value.

Generation after generation we find ourselves, or, perhaps I ought to say, we find our neighbours, straying into the same fallacies of observation and reasoning on therapeutic questions without taking heed of the warning that the admitted mistakes of our forefathers should give us. How else can we explain the meteoric series of new remedies and improved modes of treatment that whirl periodically into the therapeutic sky, and blaze for a term of years in the lustre of a reputation that seems to be amply guaranteed; only in the end to sink silently into oblivion and be heard of no more. One by one, it is true, genuine advances in therapeutics are being made; one by one remedies for disease of unquestioned efficacy are added permanently to our store, but their volume compares ill with the mass of once popular specifics that now lie as discarded litter along the path that scientific medicine has laboriously travelled.

In view of this ordinary phenomenon of medical history I do not think you will regard me as displaying an unconscionable degree of scepticism in surmising that a large part of the recent literature of certain electrotherapeutic methods will eventually share the common fate and be left derelict on the roadside in its turn. While awaiting the advent of our imaginary author, may I so far usurp his rôle as to suggest that while some of the marvellous therapeutic results we have recently read about will be referred by our philosophic successors to inadequate diagnosis, a still larger class will be ascribed by them to imperfect calculation of prognosis in the individual case. May I venture to surmise that our medical Socrates will claim to have reduced a part of our alleged curative results to the mere natural termination of transitory functional disorders, a part to the psychical relief of symptons mainly of psychical origin, and yet another part to the natural

pauses or fluctuations in the march of organic diseases which, like most forms of pulmonary tubercle, for example, normally tend to run a remittent or intermittent course; that, in fine, he will find a large number of plausible therapeutic conclusions to have been arrived at either by the common error of neglecting comparative methods of investigation, or by the equally fatal habit of drawing deductions from minor premises without taking the trouble to verify the accuracy or even to define the terms of the major.

But when destructive criticism has done its worst, and all that it can reasonably challenge is left out of the account, the body of established fact which recent electrotherapeusis can claim as her own will not, I undertake to say, appear either small or unimportant. If we limited our gaze to one department of electrotherapeutical work alone; if we even contended it had done nothing for certain outside this department; if it could be said to have shown no more than this: that in the various forms which radiant energy assumes we have a manageable means of modifying profoundly the vital processes of the individual cells; that in these modes of force we have further the power of checking, or of attenuating, or of rendering the tissues resistant to the growth of certain parasitic organisms; and that these forces can be practically utilised for the effectual treatment of such terrible maladies as lupus, epithelioma and rodent ulcer; putting the matter thus, I say, at its lowest conceivable estimate, we should have to allow that electrotherapeusis must be credited with one of the most remarkable steps in therapeutic knowledge that the present generation has seen.

But though we may single out this branch of electrotherapeutical work as being that in which its most assured successes have been won, solid advance has beyond doubt been made in many directions besides. Less conclusive, perhaps, we must admit the results in some other departments as yet to be, but therein is no ground for discouragement. Electrotherapeutic methods, we must remember, are still in their infancy, and though in other branches of work it may not as yet be possible to adduce equally complete chains of proof, we may well be satisfied for the present to see a body of presumptive evidence steadily growing and to recognise hopeful signs of what future years may bring forth. Hardly though we may credit the effects, at times alleged to have been obtained, of radiant energy on deeply seated growths, our knowledge of its penetrating powers justifies the conjecture that future improvements in apparatus may bring that too within the range of therapeutic possibilities. Though we must as yet suspend judgment on the curative effects claimed for induced vibrations in so suspiciously long a list of constitutional maladies, the knowledge we already possess

of their influence on the metabolic processes of the body forbids us altogether to dismiss the expectation that here too we may be really upon the track of therapeutic methods of the greatest value.

Nor can anyone fail to recognise, though fortunately it has so far eluded the eye of the sensation monger, the extreme interest and promise of the important work that has already been done upon the subject of Phoresis. Phoresis as a means of treatment is as yet in its earliest experimental stage, but the possibilities that lie hidden in it seem great. It is no unjustifiable hope that one day it will enable us to solve the standing difficulty of ordinary therapeutics, and place in our possession the means of accumulating effective doses of powerful chemical or physiological remedies in those parts of the organism in which their action may be beneficial, without the present necessity of diffusing them more or less equally through the fluid contents of the body and thereby eliciting their effects on organs which they influence injuriously. How far these and many other tempting possibilities are likely to be fulfilled we shall look to your Society from time to time to tell us.

Let us, moreover, not underestimate the value of electrotherapeutic work by omitting to take into account the unconscious influence it has exerted upon the course of contemporary physiological and pathological thought. If there have been times when the tendency of physiology and pathology has been too strongly towards a purely chemical explanation of their problems, recent electrotherapeutic work must be counted among the causes which have made for a fuller consideration of the part which physical forces play in the intimate life of the cell.

By the patient, reserved, and critical study of your fascinating speciality, gentlemen, by the discountenance which a strong association such as this can show towards the elements of sensationalism and extravagance with which some parts of the subject have unfortunately been associated, you will, I feel sure, be able ere long to rescue the practice of it from the hands of pretenders, and place it in its desired position as an essential branch of medical therapeutics. It is time, I think, that the public learned to recognise the danger it is running in playing with the powerful physical agencies that are the subject of your investigations. That electric applications should, like the Turkish bath, be occasionally taken in harmless forms and degrees by healthy people avowedly as luxuries is natural, and need not perhaps call for medical animadversion; but the public should be fully advised that if these physical agencies are used for serious therapeutic purposes they must be used in a serious manner and under serious responsibility by persons trained to understand the

nature and the possibilities of the maladies they are treating as well as the mere construction of the apparatus employed, and that, like other serious remedies, these agencies may be sources of danger if administered by uninstructed or half-instructed persons.

The prospective importance of physical methods in treatment, as well as the importance of physical considerations in physiology and pathology, suggest one further question, which I will venture, in conclusion, to commend to the attention of the Association. Is the place at present assigned to the study of physics in the medical curriculum commensurate with the anticipated requirements of future medical practice? For myself I should unhesitatingly say no. Medicine has been so habituated to regard chemistry as its especial handmaid among the pure sciences that I think it has been a little blind to the rapid advance of physical investigations and to the bearing they have on its own field of work. The tendency has been, I fear, to treat Physics rather as an appendage to Chemistry than as the fundamental science on which chemical conceptions themselves are largely based. I am not, I admit, raising this question on purely utilitarian grounds. In the educational world I have repeatedly urged, and not always to unwilling ears, that any scientific education, to be worthy of the name, must needs begin with the study of mathematical physics.

Difficult, we all know, it must be to find room for any fresh extension of scientific training in the crowded years of the student's career; but is there no unnecessary lumber yet included in the curriculum that could be jettisoned without practical loss to meet so important a claim? In the search for a countervailing remission of requirement, I for one would be hardy enough to lay a sacrilegious hand on the sacred ark of Anatomy itself. In the vast mass of minute anatomical detail that the ordinary student is caused to commit to memory, could there not be found, say, a poor ten per cent. of matter that the average medical practitioner would be none the poorer for never having been obliged to learn?

But this, I fear, is too large a subject to discuss at the close of a brief address: I will merely add that for my own part I should esteem the average man neither the worse educated nor the less fitted for the treatment of ordinary disease if in his early days he had given a little more attention to the undulations of ether, and a little less to the details of the sphenoid bone.

The President congratulated the Society on the address which they had just heard. He thought the custom of inviting a representative member of the medical profession to deliver an annual address to the British Electrotherapeutic Society

was an excellent one. Those whose practice was limited to the study of a highly specialised subject such as electro-therapeutics could not but benefit from hearing how their own branch of special work appeared as viewed by the medical profession at large. The address they had listened to gave them an opportunity of recovering a true perspective view of the aspects of their work, as seen from outside. He had great pleasure in conveying the heartiest thanks of the meeting.

The Past President, Dr. W. S. HEDLEY, in seconding the resolution concurred with the remarks of the President, and felt that he was giving voice to the feelings of the meeting in expressing their warm appreciation and thanks. Sir Isambard Owen had referred to Phoresis. It was certainly very slow in taking any definite place in practical medicine, but he, the speaker, felt that it had a future, if not a present, and referred to the excellent work that had been done in recent years by Morton in America, and during the present year by Leduc in France.

The address had also forcibly drawn attention to the blighting influence of unqualified practice. In London, in other large towns, and most flagrantly in our health resorts the instructed medical man sees to his sorrow electrical currents of dangerous magnitude and power administered by persons whose qualifications for the work seem to begin and end with the ability to turn on the switch; and knowing that exposed to the direct circuit of such currents the smaller animals, such as rabbits and guinea pigs, may die in a few minutes, he cannot be blind to the inference that the same currents must have potentialities for mischief even in the case of man. The practitioner who employs such unqualified assistants to administer such currents need not be surprised should his patient hold him responsible for any evil effects that may ensue. But indeed the occasion should never arise; with a little proper professional trust in each other medical men can easily arrange that for purposes of treatment patients need never pass out of medical hands. In conclusion Dr. Hedley again thanked Sir Isambard Owen for his eloquent and philosophical address, so full of sound thought and good counsel.

The *Annual Exhibition*, which had been open from 3 o'clock, proved a most interesting one, and was largely attended by members and visitors. For details of the exhibits see below. A *Conversazione* agreeably concluded a very successful meeting.

Mr. A. C. Cossor (of 54, Farringdon Road, E.C.) exhibited pure radium bromide of a high degree of activity, and neatly mounted for therapeutic application; "Spinthariscopes," showing scintillations of radium; samples of his special therapeutic X-ray tubes which limit the active area of the rays emitted; an inex-

pensive trolley suitable for a coil, etc. ; and a new form of portable high frequency apparatus. Some of these will be more fully described in a later issue.

Messrs. Harry W. Cox, Ltd., exhibited one of their well known 22-in. Spark Coils, the primary winding being so arranged that 10 different circuits could be used.

This firm also exhibited a Portable Coil which was connected to their pedestal high frequency apparatus. The efficiency of the apparatus was shown by the length of the effluve.

Mr. Cox also exhibited a new Ultra Violet Lamp with improvements by Dr. Heaton, and a new Aseptic X-ray Operating Table with aluminium top which should prove most useful in the extraction of foreign bodies from hands and feet. This table was designed by Mr. J. Hall Edwards, of Birmingham.

The exhibit of **Messrs. Crossley Bros.** (33, Manor Park Road, Willesden, N.W.) was frequently the centre of attention. Amongst other excellent apparatus the most recent productions seemed to be the "Sarnian Ozoniser" ; it produced a plentiful supply of ozone and might find a place in many a sick-room. They showed "combined" batteries, also continuous current batteries for light, with improved laryngoscope, which are very portable and suitable for either general practitioner or specialist. For aural, nasal, or throat examination their various reflectors give an excellent illumination. Their Sarnian cautery battery is an up-to-date instrument and has the advantage that it is always ready for use, either for cautery or light ; it is a polished walnut with nickel plated fittings and, containing no liquid, is convenient and portable.

A. E. Dean & Co. (83, Hatton Garden), exhibited their well-known high frequency apparatus, but with several new features ; viz : the elimination of all mobile contacts and the spark gap supported by a porcelain bridge, with glass spark box, which effectually prevents leakage. They also showed a number of ingenious electrodes for high frequency application designed by Drs. Chisholm Williams, Fenwick, Sloan, &c., amongst which was the X-ray high frequency electrode, which shows the bones of the fingers.

We noticed also heavy induction coils and high voltage interrupter. The one shown was for a 250-volt circuit, mounted on a wall switch-board, with high voltage switch, rheostats, and volt and ammeter. A light bath, which seemed to secure complete diffusion of the light, excited much interest, a novel feature being the mobility of the lamps by which they could be clustered or distributed at will. A new form of faradic coil was also shown as well as the osmosis X-ray tubes, screens, tube-holders, &c., and an illustration of the Harnack-Dean precision couch for X-ray, recently installed in the radiographic department of the London Hospital.

Isenthal & Co. (85, Mortimer Street, Cavendish Square, London, W.) showed :—Improved model of Mercury Jet Interrupter, with outside protecting jar ; Milliampèremeters, with shunts for low and high readings, dead-beat type ; new Constant Current Transformers ; new Aseptic Cautery Burners ; Electrically

Heated Sterilisers of all sizes; new pattern Portable Ozoniser; Cataphoretic Electrodes of various sizes; Universal Electrodes, consisting of jointed handle, with Brush, Membrane, Condenser and Vacuum Electrodes; Induction Coils of various sizes, &c.

The Sanitas Electrical Co., Ltd. (7A, Soho Square, W.) exhibited a very fine specimen of their Light Baths, fitted with tri-coloured incandescent lamps. Special interest, however, was centred in their new patent "Wodal" Motor Mercury Jet Interrupter and their new "Sanitas" water-cooled Focus Tube. The former enables the actual duration of contact to be precisely regulated, and thus the Interrupter can be exactly suited to the condition of the vacuum of the tube. Among the advantages of this break are its absolutely noiseless action and the fact that it does not require any regulating resistance. The advantage of the Focus Tube is that it can be operated for a considerable length of time without the anti-cathode becoming heated, and another good feature is its simple device for regeneration. There were also:—

New pattern Horizontal High Frequency Apparatus with silent spark box and new adjustable solenoid with fine hand adjustment.

New pattern Vertical High Frequency with silent spark box, and fitted with two sets of Leyden jars of differing capacity to interchange.

Skiameter, with eight varying thicknesses of platinum and moveable screen, arranged so that the penetration of vacuum tubes may be adjusted and compared.

The Ægis Synchronous Motor Rectifier, for working X-ray apparatus direct from the alternating mains.

Mr. K. Schall (of 35, Great Marylebone Street) exhibited various well constructed high frequency apparatus with large condensers—the newest d'Arsonval and Tesla transformers, and a revolving resonator; the spirals of this are efficiently insulated to prevent leakage, and the effluve is consequently unusually great.

He showed, moreover, a spark coil with jet interrupter, and a galvanometer to measure the currents passing through a Röntgen tube; Dr. Wehnelt's new X-ray tube, with adjustable vacuum to make the tube soft or hard at will; Dr. Wehnelt's new actinometer; a shunt wound sinusoidal motor for three-phase currents, with transformer to regulate and a galvanometer to measure the sinusoidal current; and his well-known switch boards for using the current from the main. Surgical lamps for bladder, urethra, mouth, ear, &c., were also exhibited.

PROCEEDINGS OF THE BRITISH ELECTROTHERAPEUTIC SOCIETY.

Edited by CHISHOLM WILLIAMS, F.R.C.S.Ed., *Hon. Sec.*

OCTOBER 23rd, 1903.

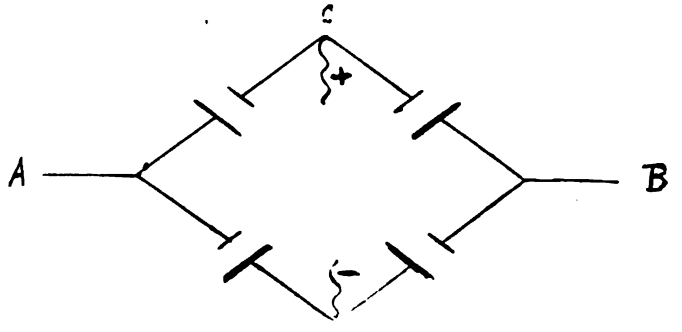
THE Fifteenth Meeting was held at 11, Chandos Street, Cavendish Square, W. The President (Dr. LEWIS JONES) in the Chair.

The minutes of the May meeting were read and confirmed. Eighteen nominations were read and laid on the table for signature.

The ballot was then taken and proved unanimous in favour of:—Drs. Dawson Turner, 37, George Square, Edinburgh; A. M. Ross Sinclair, 231, New Kings Road, Parsons Green, S.W.; H. M. Bundey, 1, Honor Oak Road, S.E.; D. R. Rowlands, 17, Hazley Road, Edgbaston, Birmingham; H. E. Gamlen, Chadwick House, West Hartlepool; D. H. Hutchinson, 55, High Street, Lowestoft; D. W. Wiseman, 428, Commercial Road, Portsmouth.

LIVETT'S RECTIFIER.

The President showed a form of aluminium rectifier, designed by Mr. S. G. Livett, of 58, Balham Hill. He said that it consisted of four cells, coupled up in the usual way as a Wheatstone's bridge.



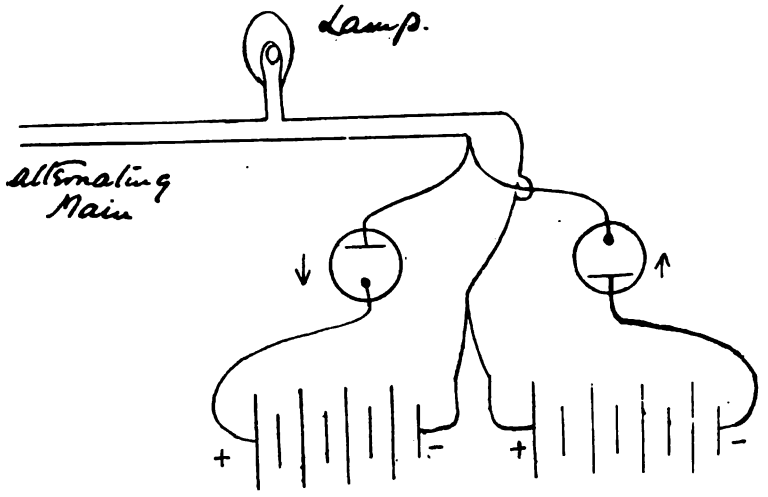
A B to Mains. *C D* to battery to be charged.
In the cells the arrangement is easy to understand, the short strokes = aluminium.

The electrolyte used was saturated sodium sulphate solution, the immersed aluminium was of small surface, the other metal in the cell was sheet iron. There was a two-way switch for (1) polarising the system, (2) for charging the accumulators, the regulating resistance was in the charging circuit and consisted of a lamp or lamps in a socket attached to the framework of the apparatus.

The apparatus was very neatly fitted in a mahogany box with plugs, switches, &c., for the price of £3 3s.

The liquid in the cells heated during the passage of the current, but this did not appear to be a serious objection. A simple adjusting screw enabled the aluminium rods to be fed down into the electrolyte as they were consumed.

A very simple form of aluminium rectifier may be made as follows. Two jars are nearly filled with a saturated solution of ammonium phosphate in distilled water, and a sheet of iron (hoop iron answers very well) and a rod of aluminium, about a quarter of an inch in diameter, are fitted with binding screws, and put into each of the jars for electrodes. The arrangement of the two cells in the circuit as follows :—



The current passes easily from iron to aluminium, *i.e.* in the direction of the arrows, and there is thus an easy path and a difficult one, whichever be the phase of the alternating current at any moment. The lamp determines the rate of charging, and if it is a 32 candle, the charging is a mean current of 0·6 of an ampère for each of the two accumulators, although in reality it is a current of twice that amount (1·2 ampère) for each accumulator for half of the time. When one wire is positive one of the two is getting a charge, when the other is positive the other accumulator receives its charging current.

By working in this way there is no over-heating, and the cells can be left running all night. The aluminium rods wear away slowly, but will last three months or more. The jars need filling up with distilled water occasionally.

Dr. CHARLES HEATON showed a High Frequency Resonator, made by Cox & Co., with improvements suggested by himself. These took the form of a couple of switches, whereby the patient could be thrown in or out of the primary solenoid circuit, thereby saving time and the inconvenience of undoing the usual wire attachments.

In the unavoidable absence from illness of Dr. G. M. LOWE, Mr. CHISHOLM WILLIAMS read a paper on "Notes of Some Cases treated by High Frequency Currents."

Mr. President and Gentlemen,—Before going into any details of cases treated by means of high frequency currents, it is first necessary to say a few words about "efficient" apparatus, the more so as I used to be often told by other workers in this branch of electrotherapeutics that they could not get the same results as myself.

When comparing my cases with others I frequently found that, apart from the pathological conditions, there was little in common regarding the apparatus used.

Our President, in the first paper ever read before this Society, emphasised the necessity for measurement, an idea which I am sure is heartily endorsed by every member present.

The amount of initial electrical energy, the spark gap of the coil, the amount required for the working of the break are, of course, well known to the maker and worker, but the amount of current administered to the patient is most frequently an unknown quantity, and less frequently the duration of each sitting this latter I find varies somewhat with the individual practitioner from five minutes to half an hour, according perhaps to the other demands on his time.

As a general rule I believe good work can only be done by a group of apparatus, which will enable us to administer from 250 milliampères upwards, this should be measured with d'Arsonval's milliampèremeter.

The milliampèremeter being a hot wire instrument may not be scientifically correct, but for the purpose of comparison is all that one could wish. I would like just to mention in connection with the use of the milliampèremeter, that it should be so arranged between resonator and patient that it can be shunted, so that it is only "in" for the few moments required to take a reading and then cut out. My first one unfortunately burnt out in a few months by being constantly "in," the wire became brittle and snapped when lifted from a table to be placed on the wall. Regarding the "effluve" this should be tested to its utmost length from time to time, not necessarily for therapeutic use but to assure oneself that the combination is working as well as it can, and that it approximates the discharge obtained by other workers. I have several times received letters from medical men

expressing surprise at getting so little re-action in such cases as lupus, and have generally been able to detect some feebleness of discharge due to defect in the apparatus.

The great majority of glass vacuum electrodes on the market at the present time are practically useless for therapeutic purposes; they light up, it is true, but then so does a Geissler tube. The glass vacuum tubes I have found most efficacious is one in which the highest vacuum possible is attained. They were specially made for me by Dean, and require much care and patience to get the desired vacuum. When an electrode of this condition is obtained either by a quantity of hard usage or by the manufacturer it should be treasured and kept for malignant cases only. The fluorescent screen will readily demonstrate the presence of an abundance of X-rays, the luminous area being the size of a five shilling piece. In case mentioned later you will appreciate the utility of such a high vacuum electrode.

A few Cases treated by High Frequency Currents.

We will first consider *Phthisis.*—I need not weary you with a number of cases. My forty-three consecutive cases were published in our Journal for last year. Four have died during the past two years. Very briefly my experience has been as follows:—The patients increased in weight with increase of appetite, &c., as the currents seemingly increased their digestive powers. The temperature was for a time raised in accordance with the length of applications and the strength of currents. In those days I could not have given more than 200 milliampères. Now with better apparatus I am able to give 350 or so, thus considerably cutting down the duration of treatment. They all had auto-condensation, but lately I give phthisical patients the double effluve, using two resonators, after Rochfort's plan.

Night sweats increase at first, and the tubercle bacilli follow almost the same course as under the X-rays outside the body. I will now give details of a typical case in a young man, who was sent to me by a member of this society, Dr. Frank Fowler.

F. E., aged 27. Flat-keeper. Cavity right apex. Tubercle in considerable numbers. Clinical Research Association. Height 5-ft. 9-ins. Had lost weight since Christmas, 1900. Weight before treatment, 18th Sept., 1901, was 8-st. 3½-lbs.; 28th Jan., 1902, 9-st. 6½-lbs. 17 lbs. in 12 weeks. Exhibited at West Kent Medical and Chirurgical Society as arrest of phthisis, 1903. No tubercle in sputum.

Many sanatoria are now fitted up with efficient apparatus. May I be permitted to remark that electrical methods should not be condemned until great perseverance has been given

on the part of the observer, and that the greatest care be taken that the apparatus be of the most powerful description?

In tuberculosis of other parts, joints, &c., many electrical methods have been used, but in my hands the best results have been obtained by general electrification combined with a vacuum electrode from the resonator. Cases of old-standing tuberculous lesions are very amenable to electrical treatment.

The following notes are from a case under the care of Mr. McAdam Eccles, and reported by him in the *West London Medical Journal*, April, 1903. I will only give a brief extract:

Male, aged 37. Renal tuberculosis. Operation, December, 1900; sinus followed in loin. April, 1901: Sinus thoroughly scraped out, but refused to heal. November, 1901: Whole kidney, which was tuberculous in nature, removed; three sinuses persisted. September, 1902: Small nodule noticed in left epididymis. December 13th, 1902: Patient was sent to me for high-frequency treatment, locally by means of high-vacuum glass electrodes, and generally auto-condensation. January 26th, 1903: A right hydrocele formed very quickly; this gradually subsided, leaving a tuberculous testis. In March it was removed with the left epididymis. The loin sinuses had healed.

It would be interesting to know if the electricity had any part in the formation of the right tuberculous testis by developing so quickly a dormant spot. In many tuberculous cases where sinuses persist after operation electricity in a perfectly painless manner is able to promote healing in a very peculiar way.

Lupus.—That the treatment by electral currents of high frequency and high potential is a most excellent method in this disease will only be doubted by those whose experience of this form of electricity is of a limited character. As early as 1897 Dr. Brocq reported 62 cases, 16 of which were failures or abandoned the treatment, whilst the rest were cured. Lately, Dr. Bordier has reported a series of 73 cases with a like percentage of cures.

The treatment may be applied in three ways: First, by the ordinary brush effluve, this containing a vast quantity of ultra-violet rays, is or should be absolutely painless. Secondly, by means of a highly-exhausted vacuum electrode attached to top of resonator when in actual contact is warm but painless, and may be regulated by withdrawing it away from the skin as desired. These electrodes should, with the fluorescent screen, give evidence of the production of X-rays. Thirdly, by means of general electrification, by, preferably auto-condensation; combination of this latter with either of the former methods will prove of the utmost benefit.

In my book on "High Frequency Currents in the Treatment of Some Diseases," I quote two cases of lupus, one case treated by general electrification, and the other by means of the

effluve to a remote part. Both patients were successes, and are intended to suggest that whatever the electrical method we employ the general electrification is noticeable, and must play an important part in the successful treatment of the local condition.

Diabetes.—The following cases are interesting on account of the stringent diet and all other known methods of treatment having been tried with little success:

F. H., aged 36, male. Weight 8-st. 6-lbs.; height 5-ft. 7-ins.

21st June, 1901.	Sugar	per	oz.	...	... 13 gr.
3rd July ,,	,,	,,	,,	...	... 12·15
26th ,,	,,	,,	,,	...	... 11·5
1st August ,,	,,	,,	,,	...	... 9·94
9th ,,	,,	,,	,,	...	... 9·0
6th Sept. ,,	,,	,,	,,	...	... 7·2
10th Oct. ,,	,,	,,	,,	...	... 1·75

21st June. Average quantity of urine, 8¼ pints per 24 hours.
10th Oct. Average quantity, 3¾ pints.
Weight 10-st. ½-lb. Gain, 8½-lbs. in 3½ months.
1902.—9 examinations; average sugar per oz., 2·5.
1903.—7 ,, ,, ,, ,, 0·05.
Treatment: Auto-condensation ten minutes three times a week.
Present weight, 10-st. 10-lbs. (11-st. 6-lbs. normal).
Urine, average quantity normal.

C.C., male, aged 33. Without treatment 14 days. 16 pints in 24 hrs.
Sp. gr. 1036; sugar 32·3 grs. per oz. First treatment Aug., 1901.
1st week quantity fell 16 to 11 pints.
2nd ,, ,, ,, 7 pints; sugar 14·1 per oz.
After 4 weeks' treatment sugar fell to 3 gr. per oz.
Weight increased 6-lbs.: treatment continued to end of November, 1901; has remained free from sugar since that date.

Gout and Goutiness.—Beware of treating acute gout if present. Wait until the acute symptoms have subsided, using in the meantime any remedy that your skill and experience will suggest. My cases were all of old standing, and required some months of treatment; generally about three times a week for three months.

Chronic Rheumatism is particularly amenable to high frequency currents. Case with mitral systolic murmur:—

A. W. S., aged 29, female. Rheumatic fever at 16 years. Rheumatism off and on ever since. In most joints there was slight limitation of movement. Pain had been great the week before commencing treatment. She speedily in a few weeks lost all pain, the joints were thoroughly exercised, and for the past two years she has had only 13 applications general and local. She is now able to do her work as a London School Board mistress with ease and comfort. The murmur remained unaltered. 37 applications.

Sciatica.—In this condition one requires both general and local treatment down the course of the sciatic nerve by either effluve or low vacuum glass electrode in actual contact. The following, one of my early cases, is of note as exemplifying what not to do:—

H. B. M., aged 48. Had had sciatica for 13 months, during which time he had had to give up riding and other forms of exercise. In October, 1901, came to me with left knee contracted at an angle of 132°, with extreme tenderness down sciatic. Advised H. F. general and local twice a week. After due warning as to the result of more frequent applications was worse after first application. Came at end of week and asked for daily applications, as he wanted to leave for the country. Gave the current for four consecutive days, when patient went down to the country, as he could not stand the pain. Three weeks after was well, able to ride and golf. Has remained well ever since.

Palmar Psoriasis.—Right hand. Male. J. H., aged 33. Strong specific history, but had had anti-syphilitic remedies for years, and very efficient local skin treatment. Effluve to whole palm 21 times of 10 minutes each application.

Hæmorrhoids.—If recent, may be quickly alleviated—but ancient or recurrent hæmorrhoids are most difficult. If protrudable, the case can be treated by gentle sparking, and certainly respond in a most gratifying way. The majority of cases of hæmorrhoids should, of course, be treated with the knife, except in the case of old age, or objection to operation on the part of the patient.

Rodent Ulcer.—A. J. S., aged 60, male. I operated and removed the ulcer in February, 1899. In May, 1901, it recurred and was about the size of a shilling, situated over the left nasal bone and inner canthus of left eye. Firmly bound down to subadjacent bone, the eyeball was not involved. He had 10 applications of auto-condensation, whilst I used my thumb as an electrode. The ulcer quickly cleared up and he has remained cured to the present date. He was exhibited before the West Kent Medical and Chirurgical Society last autumn, and then had a dense white scar which could be easily covered with a sixpenny piec e.

Epithelioma of Tongue.—L. H., aged 38, male. Had suffered for years from chronic leucoplakia with deep cicatricial ulceration from old gummata. In the scars could be seen two small epitheliomatous ulcers. These caused such intense pain that the patient used to paint the tongue with cocaine 20 to 30 times daily. No glands. Nineteen local applications were sufficient to clear up his pain, the scars remain dense and white.

Recurrent Epithelioma of Cheek.—H. T., aged 42, male. In December, 1902, Mr. Butlin removed a small epitheliomatous ulcer from inside left cheek. Recurred March, 1903. Advised X-rays. I used high frequency and the high vacuum electrode. Twenty-four applications served to clear up the mischief. No return up to the present time.

Recurrent Carcinoma of Breast.—H. P., aged 41, female. The right breast and axillary glands were removed in December, 1901, by Mr. Gilpin. Clinical Research Association Report (Mr. J. H. Targett): "Chronic lobular mastitis, but in addition there is a recent development of scirrhous carcinoma, originating in the atrophied glandular lobules, and infiltrating the surrounding tissues."

January, 1903. The left breast was removed, and contained a similar growth.

June, 1903. Dr. Stanley Smith sent her to me as there was recurrence in both scars. Three nodules, size of walnuts, in right scar breaking down, and one in the left still intact. Treatment daily, general high frequency and local high vacuum glass electrode giving out an abundance of X-rays. Masses gradually sloughed out, coming away in thin discharge. Left off treatment in October, and went for change to the country. Weight had increased from 8-st. 3-lbs. to 9-st 5½-lbs.

December 1st, 1903. Discharge slight. No septic symptoms. Healing satisfactory.

Primary Carcinoma of Rectum.—A. B., aged 66, male. Was seen by Sir Frederick Treves and Mr .Bowlby in December, 1902. The diagnosis was carcinoma of rectum lower third, no affected glands. Colotomy offered, but patient advised to let well alone. In July, 1903, he was sent to me by Dr. Roxburgh Fuller. There was a horse-shoe shaped mass 3¼-ins. by 4-ins., protruding from rectum, no trace of sphincter and complete incontinence, with pain and much discomfort. The mass bled readily to the touch, the exploring finger could just reach above growth. Patient always ate and read standing, had not sat normally for past 16 months.

Treatment, the high vacuum high frequency electrode was used for ten minutes daily. During the first and second month the electrode stuck daily to the mass, and brought away on it appreciable quantities of growth. In the third month, in experimenting with the electrode to get skiagraph of finger tips, it was pierced. The next electrode was a low one, and came off quite clean, progress was very slow. In the next four weeks with a new electrode several times thin pieces, size of threepenny bit, came away. The whole mass became shrunken. There is now no pain, patient is able to have more control over evacuations, bleeding very seldom,

and then in quite a trivial manner. Growth is now not more than one-fifth its original size, and the patient is in every respects much better. About the middle of the course of treatment a peculiar phenomena was noticed, the great discharge of clear mucus during the applications. Although far from being a cure, yet the comfort and ease gained by the patient is extremely gratifying.

I am sure I should be the last to advocate any form of electrical treatment in operable malignant cases, but in recurrent or, better, post-operative ones, then high frequency treatment should give the greatest possible chance of alleviation, if not of cure.

I will now conclude by urging those who are working with these currents to publish from time to time their results, so that we may compare and, if possible, improve upon our methods, putting aside our electrical timidity, and remembering that we are all working with one common aim, the alleviation of disease. Most electrotherapeutic authors in their works give detailed accounts of the treatment of a very large number of diseases, certainly more than half of which "the flesh is heir to" by various forms of electrical treatment; giving such a small account of this high frequency form that one almost thinks that they are biassed in favour of the older forms. They should be the last, having electrical knowledge, to hinder the progress of their own science.

Outside our society the great bulk of our profession keep an open mind on electrical treatment, but will in the future get our opinions on electrotherapeutic matters, somewhat filtered down it is true, but nevertheless of great service to themselves and their patients.

I must apologise, Mr. President and Gentlemen, for the imperfections in this paper, my only excuse being the fact of having to collect the details at such extremely short notice.

Dr. CHARLES HEATON (Westgate-on-Sea) said that he agreed that it was not advisable to treat gout with high frequency if the acute symptoms were still present, and that this had been pointed out by Denoyès. Mr. Williams observed that he had found it out by experience long before the work mentioned was published. His case was both muscular and arthritic. In his opinion the efficiency of each particular glass vacuum electrode for local diseases depended upon the amount of X-ray discharge as previously mentioned.

Dr. HORACE MANDERS objected to the name milliampèremeter, thought calorimeter or something like it might be better.

Dr. G. B. BATTEN mentioned an interesting case of cancer "en cuirasse" of extensive dimensions, and thought X-rays the better treatment. Mr. Williams agreed with this, but for localised deposits preferred the high vacuum electrode,

as it could be placed in actual contact, and there was no fear of a surrounding dermatitis.

Dr. LEWIS JONES asked for particulars of the two girls treated at a distance from the affected part, one by general and the other by effluve on a remote part.

In reply Mr. Williams observed that one had still a yellow discoloration about the patch, and the other presented a finely puckered scar. The malignant cases were well-known to several medical men, who were anxiously watching their progress.

Dr. FERGUSSON (Great Malvern) remarked on the greater results obtained by the higher milliampèrages. Agreed that any sensations experienced by the patient were due to faulty construction or faulty connections.

Dr. DAVID ARTHUR also agreed on the quantity being all-important in general diseases.

Mr. HALL EDWARDS mentioned the case of an old patient whose white hair became under treatment practically normal. Mr. Williams had no experience of this, and presumed this must be put down to an original discovery of the speaker.

Dr. SEPTIMUS SUNDERLAND made enquiries of the relative value of high frequency in uterine diseases, especially cancer. The author of the paper referred to the published cases of Dr. James Allan. Amenorrhœa and dysmenorrhœa were undoubtedly greatly affected by electrical treatment.

The meeting then concluded.

FRIDAY, 27th NOVEMBER, 1903.

A Special Meeting was held at the requisition of the following five members of Council: Lewis Jones, H. McClure, W. S. Hedley, J. Allan and Donald Baynes, at 11, Chandos Street, Cavendish Square, W.

To add to Rule 17:

Line 4, after word not, "more than one year" in arrear.

To alter Rule 16:

Alter word eight for "Ten," inserting June and July.

This was put to the meeting and carried unanimously.

The 16th Ordinary Meeting then followed, the President (Dr. LEWIS JONES) in the Chair.

Minutes of the 15th Ordinary Meeting were read and confirmed. Eight nominations were read by the Secretary.

The ballot was then taken and proved unanimous in favour of:—Walter Knowsley Sibley, M.D., 8, Duke Street Mansions, W.; Henry Donald McCullock, M.B., Blundellsands, near Liverpool; John Campbell Maclean, M.B., Swindon House, Swindon; George Henry List, M.D., Springfield House, Stoke-on-Trent; Walter Kenneth Wills, M.B., 59, Apsley

Road, Clifton ; Thomas Davys Manning, M.B., Hoddesdon, Herts ; Arthur Frederick Blagg, M.D., 28, Caledonia Place, Clifton ; Morton Warwick Smart, M.B., 11, Welbeck Street, W. ; Cusack Roney Schofield, M.B., 17, Church Street, Southport ; William Allen, M.B., 48, Kersland Street, Glasgow ; John Geary Grant, M.R.C.S., The White Hall, Llanwrtyd Wells ; Arthur Greene, M.D., 4, Theatre Street, Norwich ; Walter Moray Shand, M.B., Cancer Hospital, Fulham, S.W. ; William Henry Bailey, M.B., The Hall, Southall, W. ; Percy Athelstan Nightingale, M.D., 56, Ludgate Hill, E.C. ; Penrose Lanyon Watkin Williams, M.R.C.S., King Square, Bridgwater ; William Cornforth Philip, L.R.C.P., Hydro, Dunblane, Perthshire ; George Quinton Richardson, M.R.C.S., 22, Woburn Place, W.C.

Mr. CHISHOLM WILLIAMS then showed the following cases:

Case 1.—Mrs. B., aged 54. *Rodent Ulcer*, size of half-a-crown on left forehead just above eyebrow. Had been noticed for three years. The ulcer was firmly fixed to the underlying bone. It was treated with X-rays—the tube operated at about 2 inches from ulcer; anti-cathode 5½ inches. Lead screen of a thickness one pound to the square foot. First application 21st May, 1902, five minutes' duration each sitting twice a week, in all 19 doses. The scar is extremely fine and size of a shilling, freely moveable. No sign of recurrence.

Case 2.—W. G., aged 61, male. *Rodent Ulcer* left side of nose size of a shilling. Treatment as above. 28 applications. On healing the scar has drawn up the nostril very considerably. Treatment ceased on September 3rd, 1903. No recurrence.

Case 3.—R.R., aged 64, male. *Rodent Ulcer* right side of nose, a shilling piece would barely cover the ulcer. Treatment as above. Treated from 13th July, 1902, to October, 1902. 28 applications. Ulcer to all appearances cured. Recurrence of two split-pea nodules, 21st August, 1903. 35 more applications of 5 minutes or less, with tube 6 to 8 inches. This patient's recurrence should have yielded much more quickly, but the applications were purposely made of a mild nature for the purpose of observation on the relative distances a particular tube should be to be effective.

The above 3 cases were sent to me from the Skin Department under Dr. P. ABRAHAM, of the West London Hospital.

Case 4.—Miss K. S., aged 28. *Lupus Vulgaris* of the whole of front part of neck from ear to ear and downwards to sternum, extended up in front of left ear, otherwise the face was free. First noticed at 9 years under chin, spread in 3 years to the extent presented in August, 1902. Had had

several scrapings at Portsmouth, and had been treated by various other processes. Treatment solely by means of high frequency currents auto-condensation ten minute doses, and the high vacuum glass electrode from top of resonator about five minutes. Applications, 48 of the former and 31 of the latter, extending over four months. The scars are pale, thin and freely moveable.

Photographs of these cases were not shown, but the scars showed the extent of the original condition. In case 4 it is interesting to note that there was a large sebaceous cyst just in front of right ear, the size of a cherry, which gradually shrunk, the contents becoming quite liquid to the touch. The cyst entirely disappeared in four months. The case on the whole did exceedingly well, but certainly after my obtaining a sufficiently high vaccum electrode the progress was greatly quickened. This high vacuum electrode will light up the fluorescent screen for an area as large as a five shilling piece, and show the bones of the finger tips. The patient's general condition was at the start decidedly poor, she had dyspepsia and constipation, with simple anæmia and amenorrhœa of several months' standing. The general electrification apparently quickly relieved her of all those symptoms.

Mr. HALL-EDWARDS exhibited a simple home-made ultra-violet lamp. It was constructed of the base of a used Nernst lamp, a portion of a card-board tube used for holding bromide paper, 2½ yards of flexible cable, a couple of wire nails, and 2 lbs. of pitch. The iron points could be regulated as to the distance between them. Mr. Hall-Edwards said that anyone having a high frequency apparatus could use this lamp without additional expense, either by connecting it with either end of the small solenoid, or by using it to replace the spark-gap.

Mr. Chisholm Williams then read, for Dr. H. E. GAMLEN, the following paper on "HIGH FREQUENCY CURRENTS IN THE TREATMENT OF RHEUMATOID ARTHRITIS":—

There is no reason why rheumatoid arthritis should be regarded as one of the chronic diseases. Providing the difficulty of diagnosis be overcome in the earlier stages when the symptoms simulate those of ordinary rheumatic pains the application of high frequency currents will provide what has hitherto been considered in the main unattainable—and that is—effective treatment. The conclusion arrived at is based upon experience of a large number of cases, and although the patients had reached conditions more serious than those which constitute the primary stages, so notable was the improvement from the electrical currents that one was led to believe that the treatment applied to the malady on its first appearance would have been thoroughly successful. And

in predicting a result of that comprehensive nature I mean that not only would the disease have been eradicated, but the personal appearance of the patients would be free from blemish and deformity, and the cure rendered absolutely complete. This confidence was inspired by the incident which I am about to relate.

Twelve months ago an unmarried lady of uncertain age, a friend supporting her on either side, limped from a cab into my consulting rooms. She complained of rheumatism, and stated that she had done the correct thing under the circumstances in going to Harrogate, but having received no benefit from the visit she left with the prospect held out by her medical adviser that she was, and always would be, a "hopeless and helpless cripple." Her condition at the time was certainly melancholy in the extreme, but happily not incurable. Formerly an active woman, she could not now attend to her wants, and had to be assisted in whatever she did and wherever she went. Besides being unable to bend her back, her jaws were attacked to such an extent that when she spoke it seemed as though her mouth was full. This condition was due to excessive hard work and sedentary habits. I diagnosed the case as rheumatoid arthritis, and then proceeded to consult numerous learned authorities on the subject. One of these definitely announced the disease as incurable, and after a prolonged wrestle with the standard erudition of medicine the writer was firmly convinced that there was much to be learned about the etiology or pathology of the disease. Curiously enough, however, it was added that nothing could be done to give certain and lasting benefit under the circumstances; then as if to secure that safety which is regarded as the attribute of numbers, the text books—Fagge, Quain, Osler included—recommended a long imposing array of—well, not remedies, but sorts of reliefs. Having from youth been instilled with a serious respect for the great authorities, I followed implicitly their directions, which consisted in administering liberal doses of stipulated drugs. The text books were quite right. Lasting benefit did not follow. Indeed the digestion of the patient, formerly impaired, was now destroyed. Having always been imbued with a desire to cure patients, and regarding that object as the primary duty of a medical adviser, I was led to try high frequency currents, and after sixty sittings the patient again visited me to-day, after a walk of three miles, and laughingly inquired as to what I thought of her chances in the London to Brighton pedestrian competition. I brought the case before the Northumberland and Durham Medical Society. Here the patient displayed a wealth of eloquence and rhetoric, which demonstrated that she had fully recovered the use of perfectly formed speech, and when Mr. A. Martin, without giving any warning of his diagnostic cravings,

ON MEDI
APR 14
LIBRARY

promptly began to conduct an expedition in search of the well-marked cupping existing in a region undoubtedly known as the knee-joints, she also nearly demonstrated the fact that the hand that rocks the cradle boxes ears. On this occasion I showed two X-ray photographs. In one of these the bones were observed to be much swollen and translucent, particularly at the joint surfaces. The translucency, in my opinion, was due to the loss of density caused by the absence of the inorganic salts which usually enter the composition of the bone. The cancellous elements of the bone show a want of structure, and the articular surfaces of the joints, besides being noticeable for peri-articular thickening, are also more extensive than usual. The swelling in the actual joints caused the bones to be abnormally separated. The second radiograph taken after cure showed the hand with its intricate parts to be as near approaching perfection as possible, all the well-marked changes evident in the former photograph having disappeared entirely.

THE TREATMENT ADOPTED.—Since the case referred to I have had considerable opportunities of acquiring first-hand experience. As a result the writer thinks that the most efficacious method of treatment is that known as "the Couch" (Dean's) or "auto-condensation." Applications lasting twenty minutes and given three or four times weekly are adequate. The only change noticeable in a patient under treatment is languor; some increase in pulse rate and volume; with the outbreak also of perspiration. During the period of treatment it is significant that there is absence from a certain amount of pain. After a time the symptoms of the disease gradually vanish. First the cold disagreeable clammy sweats decrease, and, as the circulatory system regains its tone, finally disappear. Then the joints lose the characteristic odema, and the skin resumes a healthy appearance. These intervals at which improvements take place constitute a period varying from 60 to 80 applications when, as a rule, the patient is restored to good health. When the joints are not painful and inflamed a helpful addition may be made to the treatment by the free sparking of the parts affected from a vulcanite electrode, the discharge being taken from the resonator; afterwards the joints should be massaged or stimulated by a mechanical vibrator. All the time patients might with advantage take a nitrogenous diet. In chronic cases where muscles are much degenerated time is gained by also using magnetism. X-ray examinations of the affected parts through fluorescent screens assist in the prognosis; whilst a radiograph at the outset will enable one to locate the extent of the disease.

A THEORY.—The question naturally suggests itself: Why should high frequency currents succeed where medicinal treat-

ment, recommended by high authorities, so often fails? At present one can only theorise. I believe that the copious discharge of electrical energy acting upon the circulation of the vasomotar centres causes dilatation of the blood vessels. The direct result of that condition is freer lymphatic flow through the diseased and disabled tissues. The spark discharge, though more local, has a similar effect. Consequently the whole system is strengthened, and revived to a tone which enables it to reject the ravages of disease. It is obvious that a vigorous bombardment of tissues, even though mechanical in its origin, must be life-giving, inasmuch as it causes a healthy and improved circulation. The concurrent utilization of massage also awakens the former morbid material, which vanishes by the natural processes and enables the weakened tissues to resume normal action. It is in the earlier stages of the disease, before there is destruction of the cartilages of the joints, that high frequency currents will undoubtedly effect a complete cure. Presuming, however, that the disease has so far advanced as to actually eliminate the cartilages in the joint surfaces the treatment will materially improve the condition. Under such circumstances the most that can be expected is increased, but somewhat restricted, movement of the joints, strengthened muscles, absence of pain, and healthy action of the various glands in the system. The operation and advantage of electrical currents in cases of rheumatoid arthritis may be realised when a close study is made of the origin and character of the disease. And in this connection it is interesting to record that in the cases which have come under the attention of the writer the primary cause may be due to many things. Sedentary habits and inadequate nourishment were responsible in at least four patients ; while colds, influenza and childbirth were reasons which accounted for the other cases. Profuse leucorrhœal discharge marked five of the cases, but as this feature was not obvious until the arthritis had advanced it could only be regarded as merely a secondary symptom. Apart, however, from the selection of a "definite" primary cause, the ancient but accepted belief that the function of the trophic centres were affected may again be urged, but without any undue pretensions to originality. That, of course, admits of the assumption that if the influence of these centres is not entirely destroyed it is possible to fully restore their function and give back the sufferer normal health. The pathology of the complaint presents definite features. Indeed there are well-marked alterations in the whole of the system, but more particularly apparent in the form of malutrition which is shown in ill-nourished, shrivelled skin, atrophied muscles, destruction of the cartilages, absence of atrophied condition of the articular surfaces, this latter feature causing painful contractures and misplacements. All

these changes were clearly defined in the radiographs of the cases under my treatment, and were especially prominent in or about parts forming joints of wrists and fingers. When the fact that impoverished and poisoned blood causes the metabolic changes common to the disease is readily recognised and early emphasised, it is seen at once that powerful stimulating electrical currents must be infinitely superior to medicinal treatment.

CASES.—In all the patients who have been under my treatment well-marked indications of the disease were evident at the joints forming the fingers, and also at the wrist. Some, however, were troubled with the more serious changes at the elbow, ankles, and knees, while in one instance nearly every joint in the body, particularly the spine was affected. There was one striking similarity about all the patients. This consisted in the nature of former treatment. They had all been copiously dosed with innumerable drugs. Several, however, had indulged in the additional luxuries of baths and massage. All of them were rapidly going from bad to worse, a fact which was as certain as their unhappy prospect of becoming hopeless cripples in a future decidedly immediate.

Here are the details of interesting cases :—

Case 1.—Mrs. E., aged forty-five. Duration of disease three years. The marked changes of rheumatoid arthritis were noticeable in both wrists and all the fingers, the ring fingers on both hands being particularly affected. The elbows, knees, and shoulders were attacked to some extent. The patient had been under several medicinal treatments, and had visited Harrogate, Bath, Saltburn, &c., but with no permanent benefit. After 60 applications of high frequency currents the deformities disappeared and the patient was apparently restored to normal health. Only one finger showed a slights welling.

Case 2.—Mr. J., aged twenty ; occupation cartman. Six months previous to consulting the writer the patient had received a severe injury to his right shoulder. At the time he was treated for a fracture of the upper arm, but the X-rays revealed a dislocation of the humerus below and in front of the neck of the scapula. There was great wasting of the muscles surrounding the joint. Under an anæsthetic another surgeon reduced the dislocation and broke down the adhesions. After six weeks had elapsed the arm resumed its former serious condition, which was no doubt due to the reluctance of the patient in allowing free movement of the joint in consequence of pain, and also resultant upon the atrophy of the muscles caused by non-use and pressure. A large amount of grating was noticeable in moving the bone in its articulation. From this development I concluded that high frequency currents might prove beneficial, and I now merely include

the case because it is illustrative of the type of conditions which the electrical currents will combat. An improvement set in at the outset. After twenty-five applications, free sparking of the shoulder, and the use of the mechanical vibrator the patient was able to follow light employment. This result was remarkably rapid. There is still some slight grating to be felt on movement of the joint.

The President, Dr. LEWIS JONES, in thanking Dr. Gamlen for bringing before the Society such an interesting subject as rheumatoid arthritis, observed that more importance should be attached to the attendant symptom of dyspepsia, and it should in all cases deserve careful attention. In his opinion he did not consider high frequency currents better than the other forms of electrical treatment. In his hands sinusoidal baths had given as good results. He thought that we were still in the palliative phase rather than the curative.

Dr. COWAN spoke of the great relief he had observed in patients when treated by high frequency currents. He also remarked on the theory of the causation of rheumatoid arthritis, and thought that the subject required a deal of light yet.

Dr. W. F. SOMERVILLE (Glasgow) said that while the meeting had lost nothing in the reading of Dr. Gamlen's paper by Dr. Chisholm Williams, he regretted that Dr. Gamlen had not been present himself to give further particulars regarding the cases of rheumatoid arthritis which he had so successfully treated. He had come from Scotland mainly to hear the paper read and to learn details regarding the treatment.

In three cases of rheumatoid arthritis which he had lately been treating by the high frequency currents he had been very unsuccessful. There was no doubt about the diagnosis in each case. All had been affected for 12 to 15 years with deformity, pain, lameness or other loss of function and creaking of the joints. One, a delicate lady of 35, had many of the joints involved. The other two were gentlemen in perfect general health, and in whom one hip joint was affected. A skiagraph of one of them had shown distinct signs of fibrous thickening. He had been discouraged in the results of treatment, for while the general health was improved and the sciatic or other neuralgic pain had been lessened, the pain in the joints had in no way been relieved. Slight benefit had been derived from electrical massage through the clothing, but the benefit was evanescent. While he had great faith in the curative effects of the high frequency currents in functional diseases, he failed to understand how these currents could possibly restore to a normal condition or even materially to improve joints in which serious pathological changes had occurred. He had learned from Dr. Gamlen's paper, however, hat it was necessary to prolong the treatment to 50 to 60 visits, nd to extend the duration of each sitting.

Mr. CHISHOLM WILLIAMS had treated a few cases with marked benefit as regards pain, dyspepsia, swelling; and some patients undoubtedly gained a little more movement. His skiagraphic results had not shown the slightest change. Mr. Williams' cases were all over forty-five, which, he said, might possibly account for his not having obtained such brilliant results as Dr. Gamlen. That some good can be done is certain in the majority of patients; that this good is greater than the usual drug, diet, and baths treatment will only be doubted by those who have not tried both methods. He quite agreed with the President on the value of the sinusoidal bath and other electrical measures, as iodine cataphoresis of certain joints, were all of value in the treatment of this somewhat obscure malady.

Dr. DAVID ARTHUR had obtained relief in several cases of the most prominent symptoms, and his experience had been much the same as that of Mr. Williams. He could only hope, like the previous speaker, that he might have the opportunity of treating a couple of cases in the identical condition of Dr. Gamlen's.

Dr. W. S. HEDLEY, whilst he thought that the Society was indebted to Dr. Gamlen for bringing forward this subject, regretted that the writer of the paper was not himself present to elucidate and explain it. In view of the very various theories as to the etiology of rheumatoid arthritis it seemed not quite easy to find a common starting point for this discussion. But whether we accepted the so-called "nervous" theory or the more recent "bacterial" theory supported by Bannatyne and Schuller, and strengthened by the lately discovered diplococcus of Boynton and Payne, we at least agree in recognising rheumatoid arthritis as a disease of perverted nutrition, an abnormality of metabolism. It seems therefore an obvious thing to utilise for such a condition of malnutrition the high frequency current which we have at hand, and which has a demonstrable influence on metabolic processes—a current which is in fact designated "the current of nutrition."

Bearing on the part possibly played in the function of nutrition by the vasomotor and sympathetic nerves, it may be remembered that a rabbit placed in the high frequency solenoid shows dilatation of the vessels of the ear, almost as if the sympathetic had been cut. It may be presumed that something similar occurs in man. We know that perspiration is exerted by these currents, and, speaking under correction, he (the speaker) thought that blood pressure was usually lowered.

These points associated with the facts proved up to the hilt of the increased respiratory oxidations, the increased reduction of oxyhæmoglobin, and the increase of urea and decrease of uric acid, all go to show that in high frequency currents, duly manipulated, we may reasonably look for a

means of influencing such a perverted nutrition as is met with in rheumatoid arthritis. Referring to his personal experiences he found that it was usually advanced cases that found their way into his hands—cases which had perhaps been suffering for years, and been subjected to routine treatment by drugs, massage, change of climate, and all sorts of dietaries. The joints were usually deformed, stiff, or tender. There were in varying degrees destructive changes in cartilage, the muscles were wasted, and wasted far more acutely and extensively than could be accounted for by mere disuse; the flexor muscles were contracted, there were often anæmia and intestinal troubles, and the well-marked digestive disturbances referred to by a previous speaker. In such cases, remembering the multiplicity of measures, such as continuous current, sinusoidal current water baths, static baths, heat from a luminous source, massage, manipulation, high frequency, &c., which the specialist in physical therapeutics has at his disposal, and often uses concurrently, it is impossible to assign to any particular procedure its exact share in the results. But he felt sure that, during the last three or four years that he has been systematically using high frequency, these currents have materially contributed to the success of treatment. Indeed he felt that whereas he had hitherto been, comparatively speaking, relying upon localised methods and obtaining localised improvement, he now had at his disposal an agent which really can influence those processes of abnormal metabolism which lie at the root of the whole trouble.

Although the outlook in the class of cases referred to can never be very hopeful, it may be less despondent than it used to be; indeed there are very few, even of the advanced cases described above, that cannot be in some measure benefited by the means that members of this Society have at their disposal.

As to technique, Dr. HEDLEY said that he used the small solenoid attached to the condensing couch and to the patient in the usual way—the measuring instrument showing an average of 250 milliampères, each sitting being daily from 10 to 15 minutes in duration, and continued in the first instance for two months consecutively. He also applied by means of local treatment the same current by ordinary moistened electrodes, or by the local hydroelectric bath. The current from the resonator is also used either as "effluve," or by some form of vacuum electrode.

Dr. REGINALD MORTON gave his experiences at the London Hospital, and considered the results of treatment there not very gratifying, but with increased facilities which were about to be given him he would at a future time be pleased to report on this and several allied conditions treated by general methods of electrification.

Dr. G. B. BATTEN advocated the employment of light baths in conjunction with high frequency treatment. He had not been fortunate to obtain such apparently marvellous results as the author of the paper.

Dr. DONALD BAYNES spoke on the great advantages to be derived from iodine cataphoresis. He also thought that any method that would give some relief was a right and proper one to use.

Dr. GEORGE HERSCHELL alluded to the pathological aspect of the subject and was of opinion that auto-intoxication was the most probable cause of the cases mentioned in Dr. Gamlen's paper. That this produced a condition very similar to rheumatoid arthritis was undoubted, and that possibly intra-gastric methods might have proved more efficacious than the treatment adopted.

Mr. HALL-EDWARDS (Birmingham) thought that too much stress should not be laid on the skiagraphs. They required the most careful interpretation, and the most skilful might often be led astray. He had not as yet seen any true bony structure dissolved away by means of high frequency or any other electrical measure.

Dr. BOLTON (Nottingham) and Dr. CHARLES HEATON (Westgate-on-Sea) having remarked upon the paper, the meeting concluded.

DECEMBER 17th, 1903.

The 17th Ordinary Meeting was held at 11, Chandos Street on Friday, 18th December, Dr. HEDLEY, Past President, in the Chair.

Minutes of 16th meeting read and confirmed.

Eight nominations were read by the Honorary Secretary as duly approved by the Council.

The following gentleman was unanimously elected an honorary member: Dr. A. G. Bateman, of Queen Anne Street, Medical Defence Union.

The ballot was then taken and proved unanimous in favour of: Hector Munro, M.B., Barkerend Road, Bradford; John Donald Pollock, M.D., 98, Earl's Court Road, W.; Archibald Douglas Reid, M.R.C.S., 23, Upper Wimpole Street, W.; William Nichol Elder, M.D., 6, Torphichen Street, Edinburgh; James Hearn, M.R.C.S., Bolingbroke Hospital, Wandsworth; Arthur Stanley Green, M.B., 9, West Parade, Lincoln; Edward Watson, M.D., 25, Fitzwilliam Place, Dublin; Edward Stanislaus Worrall, M.R.C.S., Cecilia Park, Crouch End, N.; Clarence Arthur Wright, F.R.C.S., 496, High Road, Leytonstone.

The meeting then adjourned for the Conversazione, already reported.

THE LIGHT CURE AND ELECTROTHERAPEUTIC INSTITUTE, LIMITED.

The Lancet, 12th December, 1903, says: "A prospectus has been filed with the registrar of joint stock companies and a copy has been forwarded to us setting out the advantages of securing shares in an institution called 'The Light Cure and Electrotherapeutic Institute, Limited.' The directors are Sir Edward Noel Walker, K.C.M.G., formerly Lieutenant-Governor of Ceylon; Mr. J. W. Sidley and Mr. J. F. Shone, both of Hampstead, and Mr. Alderman D. S. Ward, of Harrogate. The objects of the institute are to provide light cure and the more modern methods of electrical treatment for the general public, and to supply electric light and heat baths as substitutes for the Turkish bath. It is stated that the institution will be under the constant supervision of a thoroughly qualified medical gentleman with special experience, who has placed his services at the disposal of the institute. He is a brave man. If this institution proposes to carry on the treatment of all the dangerous and chronic conditions for which light cures and electrotherapeutics have been recommended, so far as we can see it will do an extensive trade as a quack association. Undoubtedly the prospectus attempts to provide for the situation by mentioning the constant supervision of this thoroughly qualified medical gentleman, but it must be remembered that if the institution is not run according to lines that satisfy the General Medical Council a thoroughly qualified medical man will cease to be thoroughly qualified, or to be qualified at all. It appears to be suggested that members of the public having 'gout, rheumatism, lumbago and sciatica, catarrh and influenza, anæmia, obesity, neuralgia, insomnia, hysteria, and nervous affections generally' should have resort to the electric light baths of the institute; and the prospectus continues in its next paragraph: 'The estimate arrived at and checked by experts . . . . . shows a very large profit upon the proposed capital.' We can quite imagine that an institution proposing to embark in the West End of London upon the treatment of the public generally, when suffering from such a list of diseases as that which we have set out, might make large profits. 'The unique character of the institute and the style in which all the arrangements will be carried out should attract the patronage and support not only of the general public but also of the wealthy and fashionable circles,' says the prospectus, and we think that the probabilities of the case are well gauged. But the question that concerns our readers is—Might the institute not do, as well as a good trade, a great deal of damage? Can we not imagine a member of the public, who thinks that his 'anæmia' or his 'obesity' constitutes his disease, walking off to the institute and paying his two guineas or his five guineas for a course of treatment that is especially bad for his general condition? The prospectus suggests that patients should be sent to the institute by medical men, but it does not suggest that the handsome estimated profits will be obtained if *only* such patients are received, while

it is quite clear that the institute proposes to do a large medical business. The public can choose their own disease out of a long catalogue and can have any treatment they like if they pay for it. We need hardly indicate to our readers that such an institute is not a thing to be joined, and we shall be very much surprised to learn that any medical officer whose name is on the register will be found to work for it. Such an institution can only be made really useful to the public if the management is in the hands of a strong medical and scientific directorate."

American Röntgen Ray Society.

This organization will meet at the University of Pennsylvania on December 9th and 10th, 1903. The President's address will be delivered by Prof. Arthur W. Goodspeed, Ph.D., of Philadelphia. A long and interesting programme is promised.

NOTICES.

All correspondence should be marked "Editor," and should be addressed to Mr. A. SIEGLE, 2, Langham Place, London, W. American correspondence and payments to be sent to 79, Madison Avenue, New York.

For particulars as to Advertisements apply to Mr. A. SIEGLE, 2, Langham Place, W. Telephone 3041 Gerrard.

Advertisers are reminded that nearly every method of treatment dealt with n this Journal involves the use of apparatus in one form or another.

Payments (excepting for America) to be made by Cheque or Post Office Order payable to the Manager, "Medical Electrology and Radiology."

Scale of Charges for Advertisements :—

			SPECIAL POSITIONS.		
WHOLE PAGE	£3 0 0		WHOLE PAGE	£4 0 0	
HALF PAGE	2 0 0		HALF Do.	2 10 0	
QUARTER PAGE ...	1 0 0				

Discount for a Series of consecutive insertions.

MEDICAL

Electrology and Radiology.

No. 2. FEBRUARY, 1904. Vol. V.

EDITORIAL.

The announcement recently made by Professor Charpentier of the French Academy of Medicine that the human body —more especially the muscles and nerve centres—is a source of "N" rays is of interest to the profession. It is hoped that they will be of clinical assistance in determining the position of muscles, the peristaltic motion of the stomach and intestines, and the movements of the heart, liver and diaphragm. Their effects on small sparks in air attracted the attention of M. Blondlot, who first discovered them in the discharges from a focus tube, and named them "N" rays in honour of his university—Nancy. Although their wave-length has still to be determined, there are good reasons for believing them to be true etherial undulations (*i.e.* light waves), and not ions, electrons, auræ, effluvia or other particulate emanations. They occupy a place between the infra-red and the shortest known wave-length Hertzian rays. Their most characteristic properties are high refrangibility, great penetration, and power of increasing the luminosity of luminous substances like calcium sulphide: in short, they increase phosphorescence, but do not initiate it. They can be reflected, refracted, polarised and brought to a definite focus (by means of a quartz lens) like other light-rays; but differ from them in the ability to penetrate aluminium, black paper, and most substances transparent to the Röntgen rays. Unlike the "X" rays, they exert no photographic action. Besides the two sources already mentioned, it has been noticed that they proceed from silver of talc heated to redness, and the ordinary gas-flame burner without a chimney. This relation to radiant energy helps to bridge over the gulf between electrical action and radiant energy. It is believed by some that they are—to use a figure of speech borrowed from our notion of colour vision—complimentary to the "dark rays," which Gustave Le Bon, of the French Academy of Science, in 1897, discovered proceeding from the unilluminated surface of thin opaque metallic plates, exposed to the action of ordinary light. If this be true it would appear that certain ethereal vibrations, beyond the two ends of the visible spectrum, exhibit similar powers of penetration, those at the ultra-violet end being, in addition, photo-chemically active.

ON THE METHODS OF APPLICATION OF HIGH FREQUENCY CURRENTS.

By Clarence A. Wright, F.R.C.S., E., &c.

It is to be deplored that the classification of the methods of application of High Frequency has not kept pace with the rapid development of our knowledge of the subject. This want of definition has compelled writers to enter into all the details of the technique employed, much of which could be eliminated by the judicious use of some comprehensive expression, that would completely and adequately present to the already informed mind of the reader the ideas, which the writer is seeking to convey. No apology is needed, therefore, for the attempt to introduce certain expressions, which if adopted, will enable us at a glance to recognise all the details of the technique employed. In the selection of these I have endeavoured to adhere to fundamental forms, which will establish their continuity with similar expressions used in other branches of Applied Electricity.

An elementary acquaintance with electricity leads us to recognise that a conducting body can be electrified either by its *immediate* relation with a source of electrical energy, or *inductively* by its proximity to a capacity so influenced. We can, therefore, distinguish two large groups, into which Vibratory Electrisation may be divided, viz. :—

(*a*) Immediate Vibratory Electrisation.

(*b*) Inductive Vibratory Electrisation.

Immediate Vibratory Electrisation :—To arrive at the further sub-divisions of this group, it is necessary to digress, somewhat, to consider certain peculiarities that can be noticed, when a neutral capacity is brought into immediate relation with a source of electrical currents of high frequency. If such a body be connected by means of a good conductor—say a metallic wire—with any circuit traversed by a rapidly alternating current, it at once becomes the seat of stationary oscillations, being charged and discharged synchronously with every variation in the direction of the current. The presence of a metallic conductor, although potentially more active, is, however, in no wise essential to the success of this experiment; for the current discharges that pass between an active capacity—say an electrode—and a neutral capacity, to which it is approached, are also capable of setting up these stationary oscillations. Thus do we notice that a body can become actively electrified not only by being placed *in derivation* on the discharge circuit of an alternating current of high frequency, but also by being brought into

immediate relation with such a circuit by means of *current discharges*, which replace the metallic conductor employed in the case first considered. The former method can legitimately be termed "DERIVATION," while the latter can as aptly be called "EFFLUVATION."

INDUCTIVE VIBRATORY ELECTRISATION.—In speaking of Induction it is usual to differentiate and distinguish Electro-Static from Electro-Magnetic Induction. A condenser or Leyden jar affords us the best illustration of the one, while a Faradic Coil may be selected as a typical example of the other. Using these types as the norm, to which our ideas must conform, we can divide the methods of Inductive Vibratory Electrisation into two sub-groups, *i.e.* Treatment by Condensation, and Treatment by Auto-Conduction.

It is evident therefore that we are now in a position to distinguish four distinct methods of vibratory electrisation, viz. :—

(α) *Derivation*, in which the body is brought into immediate relation with a circuit traversed by the oscillatory currents ;

(β) *Effluvation*, whereby a capacity is immediately influenced by the current discharges which pass between it and an active electrode to which it is approached ;

(γ) *Condensation*, in which the capacity is mediately charged by electro-static induction ;

(δ) *Auto-Conduction*, in which the electrification of the body is due to electro-magnetic induction.

In considering the further sub-divisions of these chief methods, it seems to me expedient to detail for the benefit of those not fully acquainted with the subject the variations of technique which, are peculiar to each individual method, the procedure by which graduation can be effected, the duration and frequency of the sessions, and lastly the physiological and therapeutical action. Perhaps it may be considered that some explanation is needed of the peculiar use of the word "*session*" as a substitute for the more common term "*sitting*," which we at present share with photographers and artists of that ilk, or for the now odious "*séance*," which has fallen into disrepute by its intimate association in the mind of the public with clairvoyance, spiritualism, and buffoonism of the same type. Surely this archaic, though somewhat obsolete, meaning of the word "session" is worth reviving, in order to educate the public to distinguish the attendances made for professional treatment from the other appointments made by photographers and clairvoyants generally.

Treatment by Derivation.

There are seven distinct methods of direct application included in this group, which can be distinguished either by the nature of the circuit, the relative position of the electrodes or by the character of the electric flux.

(*a*) *The nature of the Circuit.*—It has been already said that currents of high frequency can not only circulate in a closed, but also in an open circuit. The mode of application, in which the stationary oscillations (set up by currents flowing in *open* circuit) are therapeutically employed, is known as "*monopolar*" or "*unipolar*" derivation; while that, in which the body of the patient forms part of a *closed shunt* circuit, is in contradistinction referred to as "*bipolar* derivation," or "derivation *proper*."

(*b*) *The relative position of the Electrodes.*—In bipolar methods it is a matter of importance to know at every instant the position of the electrodes, not only in their relation to each other, but also to the part of the cuticular surface to which they are applied. It is obvious that this relationship may either be constant or variable. It is constant when an application is made with fixed electrodes, which maintain their relative positions during the whole duration of the session. On the other hand it is variable, when massage of a region is practised; for the movement of an electrode over the surface of the skin necessitates a more or less continuous alteration in the relation of the moving electrode to the other, and also to the individual parts brought into momentary contact with it. The term "*stabile*" is usually employed to indicate treatment carried out by *fixed* electrodes, whose relation is constant during the whole duration of the session. The term "*labile*" on the contrary implies that a more *variable* relationship between the electrodes is effected by the movement of one of the over the integument of the region to be treated.

(*c*) *The character of the Electric Flux.*—Some of the most remarkable and noteworthy therapeutical effects of certain methods of direct application appear to depend on the *continued* or *interrupted* character of the electric flux. Where massage of a part with a roller electrode is practised, and intimate contact with the skin is maintained, the

flux of the current is continuous and the amount of sensible reaction limited to a more or less pronounced sensation of prickly warmth in the parts over which the electrode is moved. When, on the other hand, a brush electrode is employed the density of the current, owing to the limited surface for contact, gives rise to a more decided sensation of burning warmth. This is increased by movement; for momentary interruptions in the flow of the current are thus produced, which manifest themselves in a shower of sparks and give rise to very painful revulsive effects.

SIMPLE MONOPOLAR DERIVATION.—This, the first of the methods of direct application, is sometimes erroniously referred to as "*unipolar condensation*" or "*condensation by attachment to one pole only*"—a contradiction in terms too obvious to require comment. It consists in connecting the patient, by means of a suitable electrode, either with one pole of the small solenoid of high frequency, with the upper free terminal of an Oudin resonator, or with the free central spire of a Reus' Cone or Guilleminot's Spiral. The body of the patient thus placed in derivation becomes the seat of stationary oscillations, whose period corresponds with that of the currents traversing the discharge circuit. It is affected in much the same manner that an insulated conductor would be, if it were connected with such a circuit. In short, one may say that it is charged and discharged with every variation in the polarity of the current traversing the closed circuit. It is needless to add that in this case the flow of the current is constant, and it circulates in open circuit.

Reaction.—The therapeutic effects of this method of direct application are systematic rather than local. The only local manifestation provoked by the passage of the current is a slight sensation of prickly warmth in the parts of the integument immediately beneath and around the electrode. This is more noticeable when the surface of the electrode is small, the tension of the current high, and the rheophore carelessly applied. With an electrode of suitable dimensions adequately fitted to distribute the current over as large a surface as possible, and due care to insure close contact with the skin, no untoward effects are observed unless the session be inordinately prolonged.

On account of its marked systemic but limited local reaction, this method is better suited for the treatment of general diseases, as asthenia and anæmia, than for purely local affections. It has, however, been found useful in sphincteralgia and anal fissure—a grooved conical metal

electrode, introduced sufficiently far, being the rheophore selected for these applications. The beneficial effects in these latter conditions appear to depend upon the *myasthenia* caused by the passage of the current along with a minor degree of anæsthesia caused by these applications.

Graduation.—No direct control can be exercised over the amount of electric energy passing into the body of the patient. Some measure of graduation of the intensity can, however, be indirectly affected by regulation of the various parts of the apparatus. It is least with the patient in derivation on the small solenoid of high frequency, when the self-induction of the discharge circuit is a minimum. When connected with a source of currents of high tension as the resonator Oudin, d'Arsonval's coil of high tension, Reus' cones or Guilleminot's spirals, all procedures tending to diminish the output of the apparatus, do also simultaneously decrease the intensity of the currents circulating in the body of the patient; for all measures tending to diminish resonance and the self-induction of the discharge circuit effect a corresponding diminution in the amount of current circulating in open circuit.

Duration and Frequency of Sessions.—No fixed rule can be laid down for the guidance of the operator in all cases. A plan, pretty generally adopted, is to start with a session of four to six minutes, and gradually extend the duration of subsequent applications till a sitting of 40 minutes is reached. The sessions are, at the discretion of the operator, repeated three times a week or oftener, according to their effects upon the patient. Any complaint of headache, malaise, and general lassitude is an indication that the sessions should be more cautiously increased and not too frequently repeated. It must, however, be confessed that these sensations, even in the more susceptible, ofttimes wear off as treatment is continued. Sleeplessness, sometimes noticed after the first few sessions, is no bar to the continuation of treatment.

REUS' METHOD OF UNIPOLAR DERIVATION.—This variation of monopolar derivation is of special interest. The patient is here connected by two electrodes, attached to the ends of a bifurcated wire, to one and the same pole (or terminal) of the small solenoid of high frequency, or of the resonator. Speaking of this method of treatment Reus says: "Treatment by this variety of unipolar applications is in its therapeutical effects somewhat similar to that produced by the bipolar method. For, in addition to the general effects upon the system, a localised concentration of the action of the current is brought about by parasitic currents, which circulate between the electrodes. It is essential to the production of

this local effect, that care be taken that the two arms of the bifurcated wire are of unequal length when employed with electrodes of like capacity, and *vice versâ*."

In support of his contention he cites the experiments of von Berzold and Hertz, as well as detailing several experiments illustrative of their electro-static and dynamical effects, whilst passing through an electrolytic salt solution (0·7 per cent.) substituted for the body of the patient. The question, however, requires to be independently investigated and confirmed before his contentions can be accepted.

Reaction.—If Reus' contention be true, the therapeutical effects of this method must closely resemble those of the method next to be described. The cases he suggests as most suitable for this mode of treatment are :—(1) Certain forms of neuralgia, ataxia and neuritis; (2) Diseases in which muscular spasm is a prominent symptom as certain forms of asthma, dilatation of the stomach due to pyloric spasm, vaginismus, sphincteralgia and anal spasm; (3) Chronic hypertrophies due to congestion, infiltration or exudation in glandular organs; (4) Cavitation in tuberculous phthisis, constipation, and pancreatic disease with diabetes.

Graduation.—The remarks made on this subject in reference to simple monopolar derivation equally apply here.

Duration and Frequency of Sessions.—This varies with the nature of the case and the effects desired. Reus commences with a sitting of 10 minutes and rapidly pushes on till the duration of the session extends over 40 minutes. They are repeated three or four times a week according to the reaction produced.

STABILE BIPOLAR DERIVATION.—This, the best known of the methods of direct application, is usually spoken of as derivation proper. Whenever the expression "derivation" is used without a qualifying epithet it is this method that is generally referred to, being that originally described by d'Arsonval under this name. In it the patient is connected by two electrodes with the opposite poles of the small solenoid, or of a resonator. The body of the patient thus forms part of a closed shunt circuit. That it is really traversed by the rapidly oscillatory currents can be proved by placing one or more electric lamps in circuit with it. The filament of the lamps, by reason of the great resistance they offer to the passage of the current, are soon brought to a red heat and rendered incandescent. D'Arsonval at a demonstration before the French Academy of Sciences placed six lamps (of 0·8 ampères at 125 volts each) between two persons in a derived circuit, and proved that even with so great a resistance the current circulating was powerful enough to render them incandescent.

The time and care given to the selection of electrodes and to securing intimate contact with the skin is well expended, as the patient can thus be saved the risk of being burnt through the lack of attention or of skill on the part of the operator.

The Selection of Electrodes.—It is a well established fact in electricity that the amount of heat generated in a conductor by the passage of a current is proportionate to the intensity of the current, the duration of its flux, and the amount of resistance it offers to the passage of the current. It is also known that *ceteris paribus*, the resistance offered by the skin to the passage of a current is inversely proportionate to the size of the electrode employed; for every increase in its surface is attended by a proportionate decrease in the resistance of the skin and a corresponding diminution in the amount of heat engendered by it at the points of contact. For this reason, electrodes of the largest size suitable for the purpose should be employed; the exception being cases, in which some special advantage is to be derived or indication followed. Here the small conical button or ball-pointed electrode may be used. As close contact is needed to protect the skin from undesired local effects it is expedient that the electrodes be made of a substance, which can readily be moulded to the irregularities of the part, to which they are to be applied.

Why Intimate Contact is essential.—When an electrified body is brought near a neutral capacity (without actually touching it) it induces on the surface nearest itself a charge of opposite sign. This results, in still nearer approach, in the passage of a spark. If, however, the conductor be oppositely charged the disruptive discharge occurs sooner, and is of greater length and intensity. When we consider that the body of the patient connected with one pole of the solenoid of high frequency is for all practical purposes a charged conductor, it is easy to understand how sparking can be set up between it and an electrode attached to the opposite pole, if carelessly applied; for sparking occurs at all points where contact fails. A revulsive effect, a cutaneous erythema, and in prolonged applications a bad burn may thus be produced. Even with the most careful adjustment, a slight sensation of tingling warmth is often experienced. This further increases as the session proceeds until analgesia sets in. It is not unusual for some degree of redness to be noticed about the parts after a sitting of long duration.

As the general contour of the body and the irregularities of many parts of its surface do not readily lend themselves to very intimate contact with electrodes of large size, several different methods have been proposed to obviate this difficulty

and overcome the sparking nuisance. The following are the chief of these :—

(*a*) *Padded Electrodes.*—Instead of using naked electrodes to the skin the rheophores have been padded—covered with one or more layers of soft leather, linen or flannel—and applied slightly damp. With delicate and hypersensitive skins this method has some advantages, being less liable to produce irritation and redness. Care must, however, be taken that there are no pleats, joins or folds on the surface brought in contact with the skin, as all such irregularities interfere with the adjustment necessary to prevent untoward accidents. Sudnik records a case of superficial burn with some deeper ulceration arising from neglect of these precautions.

(*b*) *The Electric Bath.*—Another method which insures an increased surface-capacity as well as a close relation between electrode and skin, is the use of the electric bath. Here the well-known conductivity of water and the intimate contact with the skin, that the use of a fluid electrode ensures, are brought into requisition. The amount of the body surface immersed varies with the nature and the requirements of the case. It has been most successful in the treatment of nervous diseases of infancy, as well as in diseases affecting the digits of both hands and feet. The part or parts to be treated are plunged in a bath, connected by a graphite carbon or metal electrode, with one pole of the solenoid, while the other electrode, connected with the opposite pole, is applied to some part of the body above water level.

(*c*) *Schnée's method.*—This modification of the bath method requires separate notice. It is an adaptation of Stephenson's method to treatment by high frequency, and has proved useful where several members require treatment at one and the same time. In the case where the hands and feet are simultaneously affected four small baths filled with water are connected ; two *in series* with one pole of the solenoid, and the other two, also *in series*, with the opposite pole. Into each of these a limb of the patient is introduced so as to cause the body to be the medium of connection between them.

(*d*) *The method of Phillips and Aidy.*—The part to be treated is first surrounded by a layer of moist cotton wool, evenly and regularly applied. This dressing is then enclosed in a covering layer of soft clay, in which the electrode connected with one pole of the solenoid of high frequency is embedded. The other electrode is either held in the hand or applied to some other part of the body, similarly encased. The current can thus be very evenly distributed over very irregular surfaces.

A method somewhat similar is as follows: "The parts to be treated are enveloped in a single layer of cotton wool accurately and evenly applied. This is maintained in position by careful bandaging. The whole dressing is then damped and connected with the electrode. The contained moisture distributes the current uniformly over the surface of the skin while at the same time reducing its resistance."

(*e*) *Multiple Contact.*—Another method of overcoming the difficulty of applying large electrodes over irregular surfaces is that known as the *method of multiple contact.* Two procedures have been described under this name. They differ somewhat in their technical details, and if Reus' views be correct, in their therapeutical effects also. In the first of these two or more electrodes, connected *in series* with one pole of solenoid, are substituted for the single large electrode. This allows of more extended applications being made to irregular surfaces, and where two or more parts are placed in circuit at the same time of concentrating the action of the current upon them individually.

In the other method the electrodes are connected *in parallel,* by means of a bifurcated or many-branched wire, with one pole of the solenoid of high frequency. If Reus' contention be correct the electrodes so joined set up parasitic currents, whose direction may be other than that desired. This can only be remedied by carefully adapting the capacity of each electrode to the length of wire connecting it with the point of bifurcation.

Reaction—Topical and General Effects.—The first sensation experienced with bipolar methods is one of gentle prickling and warmth in and about the parts in contact with the electrode. This somewhat increases as the session proceeds. The analgesia set up by a prolonged session, however, to a large extent prevents this being noticed. With small electrodes and a current of great intensity an erythematous blush is produced. If contact fails the passage of sparks between the electrode and skin may cause a nasty burn with or without deeper ulceration. These untoward effects, as already mentioned, may be prevented by attention to the selection of suitable electrodes and care to secure intimate contact. When the current is first turned on patients occasionally complain of a pain in the part immediately beneath one electrode. This can be remedied by a slight alteration in its position.

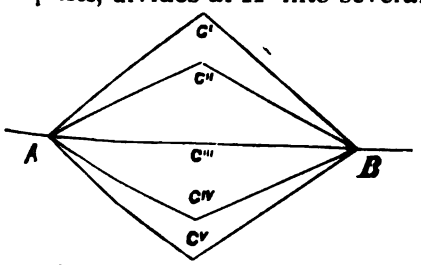
Analgesia.—In addition to these topical effects, analgesia and certain vasomotor and trophic effects making for resolution, are observed. The analgesia is more or less limited to the skin, although structures more deeply situated have been found in a minor degree to share the effect. It must be con-

fessed that the cutaneous anæsthesia is always less than that produced by effluvation.

Myasthenia.—Quite apart from the above is the physiological effects of the currents on striated contractile tissues. When these are subjected to the prolonged action of the currents a general relaxation of their contractile parts is brought about, and with it a retardation in their response to stimuli, both of neurocentral origin and those derived from a continuous current. This is accompanied by a feeling of weight and lassitude in the part, which sometimes becomes more general in its distribution. Sudnik has made use of this property of high frequency to facilitate the reduction of dislocations. It is also of great service in abolishing vaginal, anal, and bronchial spasm, as well as in the tisical cough of retropharyngeal catarrh and laryngitis. It must be remembered that the duration of the session and the intensity of the current employed have a decided effect on the local reaction.

Concentrative Effects.—Besides its general action on the system, bipolar derivation allows, by careful adjustment of the electrodes, of a concentration in a particular direction of the intensity of the currents passing through the body, and a proportionate increase in their therapeutical activity on individual parts selected for special treatment; for instance, in diseases of the respiratory system, where one electrode is placed posteriorily to one or other side of the spine, while the other is applied to the front of the chest on either side of the mesian line or sub-clavicularly. The following is the most reasonable explanation that can be offered of this concentrative effect :—

If the principal circuit, through which an electric current passes, divides at *A* into several branches, which unite again at *B*, the intensity of the current in each branch will be inversely proportionate to its resistance. Now this resistance depends on three factors :—(*a*) the length of the conductor; (*b*) its sectional area; and (*c*) the specific resistance of the substance of which it is composed. This can be algebraically represented by the equation $R=P\times\frac{L}{S}$ in which L is the length of the conductor, S its sectional area, and P the co-efficient of specific resistance. When P and S are constant it is evident that the resistance will vary directly as the length (*i.e.* R ∝ L). It is obvious therefore that in a divided circuit, where the branches C^1, C^2, C^3, C^4, C^5 are conductors having the same sectional area and co-efficient of specific resistance, the



intensity of the current passing through each branch will be inversely proportionate to its length. Now as *A C³ B* is a straight line joining the points *A* and *B*, it is the shortest distance between them, and will therefore be traversed by a current of the greatest intensity. If the points *A* and *B* be supposed to represent the two electrodes employed in derivation methods, it is evident that all structures that lie in the direct line joining the electrodes *A* and *B* will be affected by a current of greater intensity, provided always that we assume the specific resistance of all the tissues traversed to be the same. As all parts of the body are in conductive continuity and the current employed a periodic alternating one, the most distant parts are also the seat of stationary oscillations; for they may be considered as insulated conductors in derivation on the discharge circuit *A C³ B*.

The class of cases suitable for treatment by this method is large. The analgesia and myasthenia may be used to combat painful muscular spasm and in neuritis and neuralgia accompanied by muscular atrophy; in the treatment of spasmodic torticollis, bronchial asthma, the gastric and abdominal crises and lightning pains of locomotor ataxy, in sphincteralgia, vaginismus, anal fissure and muscular cramp.

The beneficial effects of the concentrative action of the currents are equally manifest in the resolution of chronic inflammations, indurations and exudates and the dispersion of some forms of neoplasm, in nervous diseases accompanied by muscular contracture or atony.

This is the method of vibratory electrisation that is supposed to most directly influence nutrition and increase bodyweight.

Graduation.—As the reaction produced by the passage of the current to some extent depends on its intensity, it were well here to discuss the various methods adopted to regulate it. Where a solenoid forms part of the discharge circuit of a current of high frequency, the apparent resistance it offers to the passage of the current is increased by every addition of a spiral to the circuit. This resistance (due to self-induction) is proportionate to the frequency of the current, and is a fact of paramount importance in determining the amount passing into the derived circuit. The nature of the arrangement for regulating the number of spirals in the direct circuit is therefore a point to be considered in the selection of an apparatus of high frequency. The five chief methods of control are as follows:—

The Sliding Contact-Rod Regulator.—This consists of a metallic rod connected at one extremity of the solenoid of high frequency and fitted with an insulating handle. It can be made to slide along a groove in the supporting pillar so as to touch

any desired spiral, and by so doing throw out of the circuit one or more turns of the solenoid. In some models it passes into the interior of the solenoid; in others it touches the spirals externally. The tention of the current in the shunt circuit diminishes as the rod is pushed home and increases as it is withdrawn. The brass tube-regulator that works in the interior of the solenoid of the Carré transformer is a variation of this method of control. This arrangement allows a certain measure of general control but no finer adjustment; besides this the rod, when fully withdrawn, is apt to get in the way of the operator.

The Movable Contact-Point Regulator.—In this method the movable contact point slides along a metallic conducting rod (directly connected with one of the supporting pillars of the solenoid, but insulated from the other, which also helps to support it); its free extremity by touching the wire of the solenoid can establish contact with any desired spiral. This allows of an irregular and somewhat coarse graduation of the intensity of the current without any marked interruption of its flux, provided the contact piece in moving be broad enough to touch two adjacent spirals.

The Spring Catch.—This, the oldest and most crude method of control, is in every way objectionable. Every time the catch is removed for readjustment an interruption of the current is produced. An attempt has been made to remedy this by connecting the spring catch with one extremity of the solenoid. Although in this case the flow of the current is never interrupted, still the removal of the catch from a spiral immediately throws into the direct circuit every turn of the solenoid and as suddenly increases the intensity of the current in the derived circuit.

The Revolving Solenoid.—In this form of control the wire solenoid is wound about an insulating wooden or ebonite cylinder, its terminals being attached to the two cheek plates which serve as the axil of the cylinder; the rotations of the cylinder bring the convolutions of the wire in contact with the sliding contact point and allows of complete control over the intensity of the current passing into the derived circuit.

The Rotary Contact Piece.—This type of control is the counterpart of that last mentioned. In it the rotation of a grooved central rod is made to convey its motion to the sliding contact wheel, which follows the gyrations of the spirals while maintaining perfect contact with them. As the capacity of the wire employed in forming this solenoid is greater than that used on the diminutive revolving solenoid a finer graduation of control can thus be produced, for both capacity and self-induction influence resonance, and by so

doing the intensity of the current passing into the shunt circuit formed by connection with the terminals of a resonator Oudin.

Of these five regulations the revolving solenoid and rotary contact piece are the best form of apparatus; as with them the flux of the current is never interrupted and the graduation very delicate and fine.

The intensity of the current in the derived circuit is best measured by the moving coil ammeter. In the majority of cases a current of 50 to 200 m.a. is sufficient; but this is not the highest limit; for Sudnik, in cases of obstinate neuralgia, has with excellent results employed currents of over 300 m.a., while Denoyes has in similar cases found currents running up to 800 m.a. most effective. To demonstrate the harmless nature of the currents even when so raised, d'Arsonval passed through his body a current of three ampères and found that the local sensations were all that could be complained of.

Duration and Frequency of Sessions.—These, to a great extent, depend on the nature of the ailment and the effect produced. It is usual to start treatment with a sitting of five to eight minutes and extend the time on subsequent occasions. On an average these applications last from 10 to 20 minutes, and are repeated three or four times a week, or daily if the patient can tolerate them. A point of importance in fixing the duration and frequency of the sessions is the intensity of the current passing into the derived circuit. For the first few applications this is kept low so that the reaction of the patient can be carefully watched. In subsequent sittings (where the intensity of the current is to be increased) it is usual to start with a current of low intensity so as to test the degree of contact between the electrodes and skin, and then rapidly increase it till the maximum fixed upon is reached. After it has been maintained at that figure for some time the strength of the current is rapidly diminished till the session is at an end.

(*To be continued.*)

PRACTICAL LESSONS IN THE TREATMENT OF AFFECTIONS OF THE GASTRO-INTESTINAL TRACT, BY ELECTRICAL METHODS.

By George Herschell, M.D., London.

(*Continued.*)

Treatment of Gastric Neurasthenia.

In the management of a very large proportion of the functional disorders of digestion the main indication for treatment is the removal of a neurasthenic condition. It is now a matter of common knowledge that the group of symptoms, to which we give for convenience the name neurasthenia, is not always the expression of a true exhaustion of the nerve centres, but probably much more frequently the result of chronic poisoning of these structures by the products of defective metabolism in the tissue cells, of which the human body is built up. We can only hope to remedy this condition by the use of some physical agent such as electricity which, whilst energising the nerve cells, can stimulate the chemical and metabolic processes which are going on in the tissues.

We can make use of electricity for the cure of neurasthenia in two distinct ways: We can either act directly upon the sympathetic system of nerves and the abdominal plexuses which govern the organic life of the individual, or we can attempt by a general application to influence the metabolism of the body. The former object we attain by the direct application to the abdomen and spine of either the constant or the sinusoidal alternating current by the aid of suitable electrodes; the latter by sinusoidal baths, by general applications of static electricity, or of currents of high frequency and potential.

Whilst not underrating the beneficial effects of static electricity or of currents of high frequency, *when applied by medical experts*, I believe that we can obtain practically as good results from the remaining methods, which have also the advantage that either the practitioner already possesses the necessary apparatus or can procure them at comparatively small cost. I may say that for many years I relied chiefly upon the constant current for the treatment of gastric neurasthenia, of course in conjunction with diet, drugs, and hygiene, and I think I may venture to say that my results were little, if any, inferior to those which I now obtain with more elaborate apparatus. I shall commence therefore with a description of the simple method of which I habitually made use:

Treatment of gastric neurasthenia by means of the constant current.

We shall require a battery of from 30 to 40 cells, which may be either primary or secondary. It should be provided with a dial collector, introducing the cells into the circuit one at a time, and a galvanometer measuring up to 30 milliampères. The electrodes necessary will be a large sponge electrode about four inches in diameter for application to the epigastrium, Fig. 1.

Fig. 1.

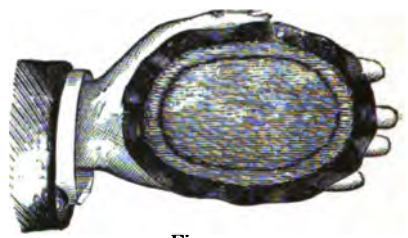


Fig. 2.

A flat sponge electrode with rubber backing provided with a strap across the back for labile applications to the spine, Fig. 2.

And a sponge electrode, about two and a half inches in diameter, provided with a handle for use upon the sympathetic in the neck, Fig. 3.

Fig. 3.

The technique of the treatment is as follows :—

We commence our application by connecting the electrode shown in Fig. 1 with the negative pole and placing it on the epigastrium of the patient who sits upright and holds it firmly in position. The sponge electrode shown in Fig. 2. is attached to the positive pole and secured to the hand of the operator or held by the straps, and placed upon the patient's forehead. The cells are then switched into circuit one at a time and very slowly, until the galvanometer registers one milliampère.

Now pass the electrode very slowly from one side of the forehead to the other, and then over the centre of the head to the vertex, remaining there for about a minute. Whilst the

electrode remains stationary in this position gradually switch in a few more cells until two or three milliampères are passing. If the patient should experience a sour or metallic taste in the mouth it indicates that too much electricity is passing, and the current should be reduced until just past the point at which this becomes imperceptible. If there should be a subjective sensation of a flash of light it denotes that the cells are being switched into the circuit too rapidly. Some neurasthenics are so sensitive to electric stimulation that the increment of one cell provided by the collector is too great. In these cases it is necessary to place a rheostat in the circuit in addition. It must be carefully borne in mind that the correct current strength to pass through the head is one which will not stimulate the nerves of taste and yet if increased ever so little would do so. Before removing the electrode from the vertex the current must be again reduced to zero, doing this very gradually, the process occupying at least two minutes. The next step in the treatment is to pass the labile electrode slowly up and down the spine, the epigastric sponge remaining stabile. Commence below over the lower lumbar vertebræ holding the electrode firmly pressed in position whilst you switch in the cells and increase the current to the point of tolerance of the patient. As the back is not very sensitive you may give from 5 to 15 milliampères without distressing the patient. You now slowly by a shuffling motion move the electrode up the spine until you reach the seventh cervical vertebræ, when the current strength must be again reduced to two milliampères, and this strength must not be exceeded until you reach the occiput where, allowing the electrode to remain stationary, you again increase the current until just short of producing the metallic taste. Again reduce the current as you travel down until you pass the seventh cervical vertebræ, when you again increase it up to the maximum dose. After a few minutes' treatment of the spine in this manner, you change the labile electrode for the one shown in Fig. 3 and finish the treatment by applying the current to the pneumogastric and sympathetic nerves in the neck. This is done by carrying the electrode up and down the inner border of the sterno-mastoid muscles from just below the angle of the jaw to the suprasternal fossa. You treat each side in this manner for from one to five minutes, moving the electrodes very slowly and giving about three milliampères. If too strong a current be used or the electrodes are moved too quickly vertigo is apt to be induced.

The total duration of the whole process should not exceed seven minutes on commencing a course of treatment, and should be gradually increased from day to day until the *séance* lasts for 20 minutes. Although marked benefit is often experienced after six or seven applications, the treatment

should be continued for at least six weeks for any permanent benefit to be hoped for.

There are several practical points which should be borne in mind, as their observance makes a considerable difference to the comfort of the patient and to the success of our treatment.

(1) A little bicarbonate of soda should be invariably added to the water in which the electrodes are wetted. As anyone can ascertain experimentally, this will materially increase the conductivity and consequently the amount of electricity which will reach the patient. Soda has the advantage over salt or vinegar which are sometimes recommended for the same purpose, that it does not corrode the metal of the electrodes.

(2) Sponge is undoubtedly the best material for labile electrodes as it holds water well, can be quickly cleaned and rendered sterile with formaldehyde soap, and runs better over the surface of the body than any other substance with which we are acquainted.

(3) The electrodes for use with the constant current must be as wet as they can be without dripping. If they are so, we can use the largest amount of current with the least annoyance to the patient. Anyone who will take the trouble to compare the sensations produced by merely damp and by well wetted electrodes respectively upon his own skin will be quickly convinced of the superiority of the latter.

(4) The labile electrode must be well soaped with shaving soap. It will then be found to glide much more easily over the surface of the body without pulling the skin, and the application will be much more comfortable to the patient.

(5) All rapid rates of change must be avoided. Increase the current by successive steps, pausing at each until the sensory effects have subsided. As Monnell has pointed out, the point at which sensory effects do not subside will usually denote the full dosage.

(6) Before applying the epigastric electrode carefully examine the skin, and if any pimples or abrasions are found cover them with plaster. Likewise, if the patient complains of sharp pain stop the application and examine the spot, otherwise you are likely to get small burns which take sometimes a long while to heal.

(7) Remember that if you move a labile electrode quickly you produce a stimulating effect. For sedation you must move it moderately slowly with a shuffling movement. Always keep up the same firm pressure on the skin.

(8) Before applying the current to the head always wet the hair thoroughly with water containing bicarbonate of soda.

(To be continued.)

THE TREATMENT OF SOME FORMS OF EMBRYONIC GROWTHS BY ELECTROLYSIS.

By Charles R. Dickson, M.D., Toronto, Canada.

Electrotherapist to Toronto General Hospital, Hospital for Sick Children, St. Michael's Hospital; Ex-President American Electrotherapeutic Association; Vice-President International Association of Railway Surgeons, &c.

The growths to be considered in this brief paper are some of those "congenital circumscribed cutaneous anomalies"* termed nævi, and more particularly nævus pigmentosis and nævus vasculosus.

In nævus pigmentosis or pigmentary mole the hypertrophy may be confined to an excessive circumscribed deposit of pigment in the skin, or one or more of the constituent elements of the skin may be involved as well. Moles may be of any shade of colour from light fawn to jet black, and from a pin head to a fœtal head in size; the smaller the size the more regular the outline of the mole as a rule. They may be single or multiple, covering the surface of the body with hundreds of spots in reported cases. There are several varieties of moles, for example: nævus spilus of smooth surface slightly elevated above or level with the surrounding skin; nævus verrucosus of rough, uneven and warty surface; nævus lipomatodes thick, soft connective-tissue growths, usually subcutaneous; nævus pilosus covered more or less with hair.

In nævus vasculosus or nævus flammeus the blood vessels of the skin and subcutaneous tissue are the elements involved. The capillary form is the one most frequently met with, the venous least so. Vascular nævi may be of any colour from the faintest blush to the deepest purple, fading temporarily under pressure, and vary from the size of a pin point to the extent of an extremity or even half the body; they may appear as a mere stain, as punctate spots, as a tortuous vessel barely below the surface, or as small or large tumours. Hutchison reports a case of a child which had over 100 vascular nævi all distinct and superficial. Varieties of vascular nævi are, nævus simple and angioma cavernosum. Nævus vasculosus simplex or simple angioma is known to the laity as "port wine stain," "strawberry mark," "mother's mark," and occurs in smooth, flat, non-elevated or very slightly raised, well-defined or faint patches. Angioma cavernosum, *tumeur érectile* or cavernous nævus is met with as a prominent, turgescent erectile or even pulsating, tumour-like growth, enlarging during crying or other emotional disturbance. The classification is that of Van Harlingen.

* Macleod.

Primarily nævi are benign growths and frequently give rise to no inconvenience or may disappear spontaneously, but such is not always the case. Thus the pigmentary form when irritated by friction of the clothing or otherwise may become inflamed or ulcerated, or alarming hæmorrhage may occur from them, or they may undergo cystic or colloid degeneration, or may become sarcomatous or even carcinomatous. Vascular nævi may enlarge to such an extent as to endanger surrounding tissue or organs causing deformity, if not actual destruction; they are subject to ulcerative or suppurative changes, may bleed profusely on slight provocation, may undergo cystic or other degeneration or develop into malignant growths. Thrombosis may also occur.

For these reasons, apart from the cosmetic standpoint, no nævus, however apparently insignificant, should be considered as being beneath our attention. All new-born infants should be carefully examined at or within a few days of birth and at frequent intervals afterwards (for nævi frequently escape detection during the early months of life), and should any nævus or suspicious spot be discovered on the skin it should be examined from time to time, and if it shows no signs of disappearing by involution by the third month it is advisable that means be taken at once to check or remove the growth.

Examples are met with all too frequently which bear out this contention for early operation in cases of nævus. A case very much to the point was recently seen: a child, five years of age, with a cavernous angioma involving almost the entire extent of each buttock and extending beneath the surface to the depth of about two and a half inches in each, with a very offensive purulent discharge from the ulcerated surfaces, and a history of several alarming hæmorrhages; the right buttock considerably larger than the left and hanging an inch and a half lower than it when the child was erect; the inguinal glands on each side enlarged and many evidences that the angioma had become sarcomatous. A spot "like a splash of red paint" had been noticed upon each buttock about 10 days after birth, but the mother had been told that it was "only a birth mark" and would disappear of itself.

The majority of the various forms of nævus are amenable to treatment by means of electrolysis, and when properly employed in suitable cases this method is preferable to any other; but as has been well said by Hayes* "in no other operation do experience and judgment play a more important part than in electrolysis of nævi." Electrolysis affords better results with less scar than any other method at present known.

An early resort to electrolysis is preferable for many reasons: the case is more amenable to treatment then than

* International System of Electrotherapeutics.

when the tissues are more matured; the operation is shorter; repetition is less necessary; more tissue may be saved; sloughing and resultant disfiguring cicatrices are less liable to occur, for the resistance of the tissues being lower a lower voltage will suffice, and should a scar result it is the more likely to disappear as the child grows.

Catarrhal conditions of mucous membranes, eruptions, or an irritable condition of the skin contraindicate operation, and if present must receive attention before operation, as they retard healing and may set up and prolong suppuration. The better the health of the child the more successful the result; apart from this nothing is to be gained and much lost by deferring operation beyond the third month of life.

Unless in the case of adults, general anæsthesia is imperative. A sudden movement might start a troublesome hæmorrhage, crying might have the same result, and it is very desirable that the patient be perfectly quiescent until not only is the operation complete but also all dressings in place as well.

No hard and fast rules can be laid down as to technique, but in general terms it may be said that when the removal of redundant tissue is aimed at, the positive pole is the one we employ in the growth, both for its direct destructive action and for the production of an artificial thrombosis, by coagulation. Where we desire to promote absorption, or to block up capillary vessels by bubbles of hydrogen, thereby causing atrophy, or where a scar is particularly to be avoided the negative pole is attached to our active electrode.

The monopolar method is usually preferable with platinum-iridium needles for positive pole puncture, gold needles for negative pole puncture, and for the indifferent electrode the perforated brass plaque or brass wire gauze, faced with absorbent felt (piano-maker's) and backed with rubber sheeting. The gold needles are convenient in that they may be bent to desired curves very readily. Zinc needles amalgamated with mercury are sometimes of service as positive active electrodes, especially in cavernous angiomata. Collodion affords an excellent extemporaneous insulation for all needles to prevent electrolytic action at the surface of the skin.

The indifferent electrode is generally placed at the shoulders, a convenient size being $4\frac{1}{2} \times 7$ inches.

In dealing with nævus pigmentosis, if hairs are present they must first be removed by electrolysis in the usual manner before the nævus proper is attacked, else they may grow up through the cicatrix. The active electrode is attached to the negative pole. In the smaller nævi the needle is introduced parallel with the surface and as near it as possible, and just sufficient current used to blanch the part; this being accomplished the needle is withdrawn and reinserted in different portions until the whole nævus has been blanched. In some

cases it is possible to attack all portions through the one external opening, especially if the needle be curved; a smaller cicatrix will be the result. It will not be necessary to cut the current down at each withdrawal of the needle as your meter should show only from one to five m.a.; but in dealing with the larger nævi where greater current strength is necessary it is advisable that no current be on, either at introduction or withdrawal of needle, and all changes in current strength must be very gradual and not abrupt. In the larger nævi and especially in the warty variety it may be necessary to employ sufficient current to mummify the growth, but caution must be exercised lest a depressed cicatrix result from too great destruction of tissue.

The nævus vasculosus simple will tax one's skill and patience, as only a very limited portion should be treated at one time. The mark should be attacked from the edges; the multiple needle devices are undesirable, a single fine needle should be used connected with the negative pole, left in position no longer than absolutely necessary and only current sufficient to blanch. The punctures may be closer together in such cases, but not so close as to coalesce. Where the nævus consists of small dilated vessels just below the surface, it is often possible to transfix the vessel and block it with bubbles of hydrogen and so cut off the blood supply to the part; current just sufficient to do this is all that is required; several spots may be treated at the one operation. In angioma cavernosum either the monopolar method is employed with a platinum-iridium needle in the growth and attached to the positive pole, or an amalgamated zinc needle used in the same manner, or the bipolar method with both needles, positive and negative, in the growth may be found preferable, especially where there is much hypertrophy. In the latter case the aim should be to insert the negative needle into or transfix the supply vessel while the positive is in the redundant tissue. Greater current strength will be necessary in the case of cavernous nævus, but rarely should our meter register up to 50 m.a.

In no conditions is the superiority of the electrolytic to other methods more forcibly demonstrated than in the treatment of cavernous angiomata of the orbit, eyelids, cheeks, nose or lips.

Hæmorrhage is not usual after electrolysis; should it occur pressure will usually suffice to arrest it. After operation a flexile collodion dressing will usually be found the most convenient. A second operation when necessary should not be performed until healing of the preceding is complete.

The temptation is usually in the line of too vigorous attack, but with electrolysis a good motto is: "Better do too little and repeat than too much and repent."

THE EXPRESSION OF NEEDLES AND SIMILAR FOREIGN BODIES AFTER LOCATION WITH THE X-RAYS.

By Edward W. H. Shenton, M.R.C.S., Eng., L.R.C.P., Lond.

It is necessary to have X-ray apparatus of sufficient power to illumine the fluorescent screen brightly for the performance of this method. A good screen is also indispensable.

The tube should, if possible, be below the part examined and the screen above.

The process can be successfully carried out on the couch of my design as the tube can be moved by the operator during screen examination.

The following description, however, will apply to most ways of using tube and screen.

(1) As soon as the needle is clearly seen upon the screen manipulate the part until the needle shadow is perfectly foreshortened—that is until its situation is merely indicated by a dot.

(2) At this stage push under the screen a metal-pointed probe until its end is on this dot. Hold steadily while the light is turned up, the current turned off and the screen removed.

(3) Mark the spot where the pointer is touching the skin.

(4) Reverse the part examined and repeat the process so that a mark is made on the skin just over the other end of the needle.

This completes the radiography.

Place the thumb of your own right hand on one mark and the finger on the other, being careful to exactly cover each mark. Now slowly but firmly approximate thumb and finger and note

(1) Sense of resistance.

(2) A creeking sensation like a mild crepitus.

If this is done slowly the pain caused is very slight.

Release for a moment and then repeat the pressure, and so on.

It will be found that every time the pressure is correctly applied the needle moves in a constant direction, *i.e.* from the broader end to the narrower. If the point is on the imbedded fragment, the process is rapid but the speed is proportional to the sharpness. It is only in the uncommon event of the two broken ends of a needle being exactly the same in area that no progress is made.

Sometimes after the first squeeze, at others after much patient manipulation, a sense of something hard and unyielding is felt under the thumb or finger of the operator; this means that one end has reached the skin.

Much depends now on the cutting power of the pointed end. If the point is on it will easily pass through, and when well protruding, counter pressure being applied now on each side, with the blades of the dissecting forceps, for example, it can be easily removed.

Next to the point the eye of the needle travels fastest and will usually pierce the skin without undue pressure. But the bluntness of a broken end will at times prevent it passing quite through, and at each pressure merely partially penetrates and then goes back to find a new piece of skin each time the tender spot is pressed. Such piece should be assisted by a Syme's knife, which should snick the skin just where the prominence shows the needle to be trying to force its way through the skin.

This method, by which some hundreds of cases have been successfully treated in the past three years in the Guy's Hospital Radiographic Department, is applicable:—

(1) To needles and portions of needles and similar shaped foreign bodies which are so situated as to allow their foreshortened images to fall clear of bone or other obstruction on a skin surface.

(2) Where the thickness of tissues does not exceed the length of the foreign body by more than four times. (This, however, is not absolute, and depends more upon the compressibility of the part.)

(3) Where the ends of the foreign body are unequal in area.

This system of urging on a foreign body is merely an adaptation of the natural process by means of which needles, &c., are made to travel so rapidly. Examples are frequent; but I venture to cite one case as a little uncommon.

A servant girl complained of having run a needle into her neck when laying her head upon a pillow.

Upon examination there was a small skin puncture to be seen just below and behind the left mastoid process.

The rays disclosed the needle lying beneath the puncture, and on deep pressure the end could be felt. Unfortunately, by some mistake, the girl went home and was not immediately operated upon, as she should have been. Two days later she returned to the hospital, when an incision was made but no needle found. Eight days later the wound being healed she came up again into my department and complained of a pricking sensation in her back.

The rays showed a needle about the superior angle of the scapular, but none in the original situation or elsewhere. Fearing the effects of further delay I cut down on this and the needle was easily extracted.

It is therefore evident that muscular effort alone will drive a needle forwards at a surprising rate, and it is as well to use this fact for the deliverance of a foreign body.

1904.

By Dr. W. S. Hedley.

(Continued.)

Before leaving the subject of radium one or two points may be adverted to. First.—Although the radiatory and allied phenomena of radium are sometimes collectively spoken of as emanations, it is necessary to remember that "the emanation" of radium has a definite and distinct meaning. It refers to that something still remaining over and above the radiations, strictly so-called—something that proceeds from radium and that can be blown away, yet that is intensely radio-active, unstable, and gradually changing to other substances, until at last it becomes something which is not radio-active at all.

When in 1896 Becquerel discovered radio-activity in uranium, he recognised in it all the properties that we now know radium to possess, only "less so." It was largely owing to his discoveries that the old idea of the ultimate atom and its stability had to be given up. The atom, small as it is (we are told that three hundred millions of them can lie side by side on an inch), is not the smallest particle of matter that can exist. The electrons that compose the atom are 1,000 million million times smaller. Their relationship to the atom in point of size being, according to Lodge, as a grain of dust shot to the Birmingham Town Hall.

The atom is to be conceived of as a sphere of influence filled with flying forces—the electrons, which are ever being flung off into space. The atom is, in point of fact, compound and unstable; its disintegration and the manner thereof is the explanation of radio-activity.

A recent point of medical interest in connection with radium is its existence in the waters of the Royal bath at Bath, and in certain springs elsewhere. It is quite conceivable that a substance undergoing such constant change and disintegration as does an atom of radium may fling off from itself something of active therapeutic value, or that may change into something of therapeutic value. Such substance being in a nascent form might help to explain the comparative inefficacy of the waters of certain springs when removed from their source; and the same fact would perhaps supply a reason for the recognised difficulty of successfully imitating mineral springs.

The subject of radio-activity cannot be left without a reference to the "N" or Blondlot rays. It appears from Professor

Charpentier's experiments (*Brit. Med. Journ.*, Jan. 16) that these rays are emitted from nerve tissues, and the greater the amount of nervous tissue present the greater their abundance, and the more physiologically active the nerve is, and the more it is injured, the greater the number of "N" rays emitted. These rays, or rather this group of rays, all act upon phosphorescent bodies.

In this connection it is needless to say that phosphorescence has nothing to do with phosphorus. The glow exhibited by phosphorus is, as we all know, due to slow chemical action, whereas phosphorescence is merely persisting fluorescence. If a ray of white light fall upon fluor-spar the latter becomes luminous. Hence any body that does the same, such as solutions of quinine, paraffin-oil, &c., are said to be "fluorescent." The difference between such a substance and a phosphorescent substance is that whereas in the former the luminosity ceases when the incident light is cut off, in the latter, that is to say in such substances as sulphides of calcium, barium, and strontium, the glow continues to be emitted *after* the incident light is cut off.

In an interesting and suggestive article (*Journal of Surgery*) Dr. Morton, of New York, describes a method of inducing artificial fluorescence in the tissues. He gives perhaps five to 20 grains of quinine before each raying. He is satisfied that in cases of Hodgkin's disease it has been of service. The question is how far the quinine would have been effective without the raying. It is reported since then that cases of cancer have disappeared under this treatment.

Now what is done being by this procedure? We know that if a solution of sulphate of quinine be held in different parts of the spectrum it is only in the blue and violet that it becomes fluorescent (as with white light), and this fluorescence also occurs with the ultra-violet rays. Now what is the nature of the light emitted from this fluorescent body? It is not only one part of the spectrum, *i.e.* it is not monochromatic—it contains various colours, but of course always of a greater wave-length than the wave-length of the light which causes the fluorescence. Ths quinine absorbs the ultra-violet or other ray, and transforms it into a lower wave-length consisting of a number of portions of the visible spectrum. In other words, the disease is being treated by *Light*.

(To be continued.)

PART II.

PROCEEDINGS OF THE BRITISH ELECTROTHERAPEUTIC SOCIETY.

Edited by CHISHOLM WILLIAMS, F.R.C.S., Ed.

JANUARY 22, 1904.

The Second Annual Meeting was held at 11, Chandos Street, Cavendish Square, W. The President, Dr. LEWIS JONES, occupied the Chair.

Present :—20 members and four visitors.

Minutes of last meeting read and duly confirmed.

The following were unanimously elected honorary members :—Sir Isambard Owen, Professor Stephane Leduc and Professor J. Bergonié.

The following gentlemen were unanimously elected members of the Society :—Anthony McCall, M.D., Boscombe Court, Bournemouth ; Septimus Farmer, M.R.C.S., 42, Princes Street, Edinburgh ; Arthur Henry Robinson, M.D., St. Mary's Infirmary, Highgate Hill ; David Findlay, M.B., 113, Woodside, Wimbledon, S.W. ; Gregory Paul Jordon, M.B., The Grove, Macdonnell Road, Hong Kong ; Alfred Walter Sikes, M.D., 40, Argyll Road, W. ; Arthur Wiglesworth Orwin, M.D., 15, Weymouth Street, W. ; Daniel Wells Patterson, M.B., 22, Eldon Square, Newcastle-on-Tyne.

Dr. BROWNE-CAITHEW then exhibited two patients suffering from lupus and sarcoma which he had treated with radium.

The first case was one of sarcoma. The patient gave the following history : About three years ago she noticed a little soft lump at the angle of the jaw on the right side. In six months it grew to the size of a small orange. In King's College Hospital the tumour was removed, with a piece of the jawbone. Nine months after leaving the hospital a lump reappeared in the region of the scar. Patient was then taken into St. Thomas's Hospital and underwent treatment with Coley's fluid—half a minim being given at first, the quantity gradually raised to 18 minims in the course of six weeks. Under this treatment the lump became painful and patient had rises of temperature to 105 degrees. Patient left St. Thomas's as it was thought that the growth was too extensive to operate on and that nothing further could be done.

On admission at Westminster Hospital, under the care of Mr. Tubby, patient had a temperature of 103 degrees. It

continued to rise. An exploratory operation was performed. Two openings were made. The temperature went down.

Note on Commencement of Treatment, Nov. 5.—The right side of the face is deformed by the presence of a hardish swelling extending from the condyle to the symphion, apparently adherent to the lower jaw and following its shape. Inside the mouth is a swelling, pushing aside the tongue and showing an ulcerated surface some two inches long by three-quarter inch wide, with raised, everted and ulcerated edges.

Under treatment by radium the appearance of the growth inside the mouth underwent a remarkable change. The sloughey character of the ulcerations gradually disappeared, as did also the everted edges—folding over, drawing together, and becoming covered with epithelium. On three occasions during treatment, after a longer than usual exposure to the rays, the patient complained of a feeling of tenseness, or tightness, *in the growth* coming on upon the day following the treatment, and she feared that it foretold the commencement of an abscess in the growth, of which she had had experience. The pain, however, was not of the same throbbing kind, and subsided in the course of a few days.

The second case was one of extensive lupus, in which Finsen treatment had been discontinued owing to the excessive irritation set up even by short exposures. The application of X-rays, on the other hand, had proved beneficial and radium had had an excellent result.

The quantity of radium used in these and in other cases which were under treatment was 50 milligrammes, and the time of exposure from five to 10 minutes in each position of application.

Dr. HEDLEY said that the case of sarcoma just shown was of interest, not only on account of its treatment by radium but also by reason of the treatment it had previously undergone. Whilst in St. Thomas's Hospital it had been treated by Coley's fluid. This fact he (Dr. Hedley) thought brought the case into line with 10 cases of sarcoma published by Mr. Coley himself, in which both toxin injections and X-rays had been used. Mr. Coley had expressed the opinion that cases of sarcoma which had proved rebellious to either treatment singly sometimes yielded to both combined. In the case just brought before the meeting by Dr. Browne-Caithew, although the treatment by Coley's fluid and radium had not been actually concurrent, they had at least been consecutive to each other within a very short time.

The President congratulated Dr. Browne-Caithew upon his possession of so excellent a specimen of this rare substance. Examining it at the close of the meeting its rays were easily discernible through a pile of fifteen pennies.

Dr. G. B. BATTEN then exhibited his high frequency apparatus, and presented the following paper :—

During my summer holidays I read some articles on wireless telegraphy by Dr. J. A. Fleming in the journal of the Society of Arts and found them most suggestive with regard to high frequency apparatus. I had long thought that the ordinary high frequency machines provided us by the instrument makers were not constructed on the most scientific principles for our therapeutic work. I therefore asked my friend Mr. Geo. Sutton, who is an electrical expert, to read these same articles carefully and give me the result of his ideas thereon with a view to building an efficient high frequency machine for therapeutic purposes. This he did, and made what I consider some valuable suggestions ; and after considerable experimentation between us and consequent modification, he built this machine for me which I have the honour to show you to-night. The points we aimed at were to get an apparatus as efficient as possible—that is, one that would give as large milliampèrage of oscillatory current as was required, while making the apparatus itself simple and with the noise from the spark gap slight. We gave up the *resonator* principle for two reasons : one because it requires tuning, but chiefly because personally I consider the long spark discharge and the effluve from the top of the resonator of very little use therapeutically. The effluve is very pretty and nice to show patients, perhaps, but of very little therapeutic value—the top part of the resonator is rather a pretty toy, in fact. If one requires sparking and effluve as one does for local treatment, I believe one can get it much better through a vacuum electrode at a much lower voltage and with correspondingly greater amount of current with greater milliampèrage, in fact, than from a long air effluve.

Theoretically we want to give the oscillatory discharge of the Leyden jars a path to travel in and surge backwards and forwards in exactly suited to their capacity—a path with as little impedence to the current as possible. Now impedence consists in (1) resistance and (2) self-induction. The resistance or "ohmage" varies directly with the length of the conductor, and full oscillatory current varies inversely with the surface ; the greater the surface the less the resistance. The impedence due to self-induction depends on the several factors which make up what is called self-induction, *i.e.* (1) the rush forward of the current which causes the moment of the current ; (2) the lag due to the momentarily opposing high voltage electro-static charges upon contiguous surfaces of adjacent turns in the conductor ; and (3) due to the electro-magnetic field and other kindred binding effects between adjacent turns. Now the whole self-induction in the conductor depends on the area enclosed by it, and on the square of the number of turns

in the conductor. Now to get as little impedence as possible we want the self-induction of moment to be high and the self-induction of lag or binding effects to be as small as possible.

As you know, to get a large electro-static charge induced we have to use large surfaces opposed to each other, and *vice versâ* when we want as little electro-static charge as possible we should use small surfaces opposed to each other; therefore a conductor consisting of a broad thin metal strip arranged with only the edges towards each other, and which obviously has a large conducting surface with practically no "ohmage," is the ideal conductor for the oscillatory discharge from Leyden jars.

Make this enclose as large an area as possible with a few turns only and we satisfy our other above-mentioned conditions, and we have then made an ideal primary for a high frequency machine. A similarly constructed secondary is placed inside or outside of this primary and concentric with it—a secondary consisting of same kind of metal strip but with more turns in it, and we have our high frequency machine, really a form of Tesla coil. As you will see we have two Leyden jars, Dean's ordinary stock size, placed inside this cylinder of wood which supports the primary and secondary spirals. From the outside of the jars very well insulated conductors are carried into a chamber, and there form the spark gap. This chamber is lined with felt and has a well hinged door, and the thick wood forming this chamber also forms the support for the whole apparatus, which you see is comparatively portable. To the insides of the Leyden jars are fastened directly the two ends of the wide copper strip which forms the primary. This primary has only two and a half turns in it and encloses a circular area 15 inches in diameter. The secondary consists of ten turns of similar copper strip placed concentrically around the primary. By tapping this secondary at any two points, by means of a simple device, one can get a current of any milliampèrage and voltage that is likely to be required in high frequency therapeutic work. (In this particular instrument we have made too large a hole in the top of the spark-gap chamber, and although closed by thick glass it allows too much noise to get out, but this will be easily overcome in future instruments.) The spark-gap chamber can easily be ventilated when not working by means of the door.

Working from the alternating mains through one of my synchronous interrupters and a heavy discharge seven-inch coil, I get up to 330 to 350 milliampères from the primary of my Dean-Oudin resonator with an ordinary sized patient on the condenser couch. From this new machine, with same couch, same patient, same Leyden jars, same coil and same interrupter I easily get 450 to 480 milliampères. Even through a

vacuum electrode applied to a patient on the couch I can get 400 or even 450 milliampères, but the sparking is then rather fierce. One can, however, cut it down by tapping the secondary at any intermediate point by this simple vulcanite hook device.

I find with a 14-stone patient on the condenser couch six turns of the secondary will give as much milliampèrage as the whole 10, whereas with a smaller patient 10 will give more than six; *i.e.* if path for current is smaller, greater voltage is required to get the same amount through. If a higher voltage or longer effluve should be required a conical or other spiral of wire can easily be added to top of this secondary; but I don't think this should be wanted as it cuts down the amount of the current. A simple long conical or cylindrical spiral can be added, however, to get long air.

Mr. Dean has very kindly arranged a coil and couch and other apparatus to allow me to show this working to-night, and he is prepared to make this simple form of high frequency machine.

Mr. CHISHOLM WILLIAMS remarked that the members were once more indebted to Dr. Batten for the exhibition and explanation, which showed a very large amount of careful investigation and hard work to conceive such a piece of apparatus as had been shown. He could hardly agree that in general practice the effluve was seldom required, as with the new high vacuum electrode in his hands he seldom used the ordinary X-ray focus tube for treatment. For auto-condensation with the couch, one was glad to hear of any apparatus which would produce a higher milliampèrage; but one must not forget that, that a piece of apparatus worked under Dr. Batten's conditions might not give equal results in the hands of other workers. Mr. Chisholm Williams congratulated him, and observed that it was a very healthy sign when members were to be found willing and able to spare time and expense in furthering any form of electrical treatment.

The COUNCIL'S REPORT AND BALANCE SHEET for the year 1903 was read and adopted. This will be printed with rules and list of members, with the towns in which they reside, and forwarded in due course.

The OFFICERS FOR 1904 were then elected as under:—

President: Dr. Lewis Jones (2nd year); Vice-presidents: Dr. Donald Baynes, Dr. Dawson Turner (Edinburgh); Council: W. Armstrong (Buxton), J. Allan (Chislehurst), David Arthur, G. B. Batten, James Barr (Liverpool), G. H. Graham, Samuel Sloan (Glasgow), George Herschell, C. R. C. Lyster, Reginald Morton, Milne Murray (Edinburgh), Septimus Sunderland, Hall-Edwards (Birmingham), James Berry (Ramsgate), Hugh Walsham; Treasurer: H. McClure; Honorary Secretaries: Chisholm Williams, J. A. Codd (Wolverhampton).

Dr. LEWIS JONES, Medical Officer in charge of the Electrical Department, St. Bartholomew's Hospital, then gave his presidential address :

We have now entered upon our third year of existence to find ourselves in a vigorous condition of growth, and with plenty of work in front of us. For the past we can say that the Society has been a success. The attendances at our meetings, the papers and the discussions have been interesting, and no one who has attended the meetings can have failed to derive valuable instruction from them. I hope the Society may continue to prosper ; indeed I feel sure that we are all assisting at the building up of a Society which is destined some day to be one of the largest and most influential of the medical societies of this country.

Our roll of membership to-day numbers 142 names. Our Journal, hitherto issued quarterly, is to appear monthly in future. Our treasurer tells me that we have no debts, and own a balance sufficient to meet any ordinary expenses which may arise in the coming year.

And now, Gentlemen, for the future, and the work we have to do. There is a matter which concerns the whole medical profession, and one in which all members of this Society are deeply concerned, and for which we must be prepared to fight. It is the matter of the invasion of the field of medical practice by unqualified persons, with the approval and support of medical men. The situation is growing rapidly worse. In electrotherapeutics we have always had to endure the competition of the common quack and the seller of electric or magnetic belts, but now the field is being invaded by chemists, and by instrument makers who carry out X-ray photography and X-ray therapeutics, and by syndicates, well organised and equipped for making money by the treatment of patients; and the matter is made very serious by the extent to which these persons and agencies are supported by members of the medical profession. Thus there is a threatened invasion of our own proper sphere of medical practice by laymen who have some knowledge of electrical apparatus and the intention of taking up this branch of medical treatment as a means of livelihood. Some of these people seem to have the notion that the treatment of the sick by electricity is a field of work into which they have a perfect right to enter. Take the following instance :—Last April I received a letter which bore signs of having been written by a person of education ; and from it I give you the following extracts, as they illustrate the situation very clearly. The writer says :—" Dr. B. has " kindly allowed me to use his name in writing to you for " information in connection with a course of lectures at " St. Bartholomew's Hospital. I have explained to him my

"intention to open an electrical establishment in London, "and my wish to take all necessary steps to become efficient "before doing so. I should be much obliged if you would "give me your opinion as to what training you consider "necessary, and whether it would be possible for me, a lay-"man, to obtain admission to your demonstrations on the "subject of medical electricity at St. Bartholomew's."

In replying I said that the teaching at the hospital was for medical men and medical students only, and that I was sorry to think that my correspondent proposed to start an establishment for unqualified medical practice; that it was unreasonable to expect me to assist in training persons for such an object, and that I thought the crowd of unqualified practitioners was already large enough. In his reply he said:—

"I am thankful to you for your letter as it will serve as an "instance of what you must pardon me, if I describe as the "unreasonable attitude of mind taken up in certain quarters "on this subject. I cannot but think that it is to the interest "of the medical profession and science itself, that reasonable "encouragement should be given to specially trained men "who desire to work under medical direction. Of these there "are several in London whose work and reputation for many "years past are a sufficient answer to the imputation con-"veyed in your letter."

The important part of these letters is that they reveal the idea of their writer that a layman was fully entitled to embark on medical practice and treatment—an idea which causes him to consider my view that medical practice should be confined to medical men as an "unreasonable attitude of mind."

It is also worthy of note that he was referred to me for assistance by a medical practitioner.

In order that the Society may realise the extent of the evil of unqualified practice in electrotherapeutics, I will now bring forward the following examples, which are a few out of many:—

(1) Here is an extract from a letter dating from Cavendish Square:—"Dear Sir,—I beg to inform you that I have, at the "suggestion of several leading medical men for whom I work, "opened a branch establishment at the above address. My many "years' experience enables me to deal with all cases that are suitable "for Mechanical and Electrical Treatment."

(2) Here is another circular, with illustrations, dated from 67, Elizabeth Street, Eaton Square. In it I find the following:— "Marvellous results. Röntgen Rays, High Frequency, Tesla, "Finsen. Skin Diseases, Lupus, &c., radically cured by Iron "Light. Paralysis, &c., treated by perfect Electro-medical appli-"ances. Skilled Male and Female operators." The addresses of branch establishments are given.

(3) Another one dated from Woodstock Street, London, W., says :—" We have on our books an efficient staff of Hospital trained " male and female nurses. . . . They can be employed by either " Doctor or Patient. We treat patients by ultra-violet lamps for " the profession."

(4) Here is a circular with prices, an X-ray photograph of a hand, and a card, from a "Member of the Röntgen Society. X-ray Specialist and Therapeutist."

In it I find the following :—" I have recently installed the best " and most up-to-date appliances, thereby ensuring satisfactory " results with short exposures, and without risk of the Dermatitis " which hitherto has been the only drawback in connection with " the use of X-rays.

" X-rays now being so largely used therapeutically as well as for " diagnosis, I propose to devote my services exclusively to the " Medical Profession for these purposes."

(5) A circular of a Swedish Institute, Harrington Gardens, S.W. Their circular includes the following :—" Physico-thera- " peutic treatment of Muscular and Nervous Diseases." Remedial agencies employed include Electrotherapy, Galvanic and Faradic Electricity, Electric baths, and so on.

(6) Here is a card of a " Nerve and Rheumatic specialist, " Discoverer of the true curative phenomena of Electrotherapy, " X-ray, High Frequency, d'Arsonval, Spark, Spray, Faradic and " Galvanic Electricity, &c. Under distinguished patronage."

(7) Is a prospectus of The Light Cure and Electrotherapeutic Institute, Limited, Capital £12,000. I mention it because it has on its list of Directors the name of Alderman D. S. Ward, whose name I see in the list of members of the Röntgen Society.

(8) The Electrical Ozone and Light Syndicate :—" Rheuma- " tism, Sciatica, Neurasthenia, Dyspepsia, Currents of High " Potential and Great Frequency are passed into the system. " Expert masseurs attend patients who are only received on the " authority of their medical men." John D. Marshall, Managing Secretary. Mr. Marshall was nominated for election by a member of the Council of the Röntgen Society, but apparently he was not elected a member.

(9) The Red Cross Light Cure and Electrical Institute " for " the modern treatment of disease by electric light and vibration. " Consultations and Röntgen Rays examination free. Patients " treated under the supervision of their own Medical man if " desired. Or a qualified medical man can always be consulted " at the Institute, Edgware Road, Marble Arch, W."

Chemists of good repute have also embarked in electro-therapeutic treatment, and thus have put themselves in a position of open antagonism to the medical profession, and in direct competition with members of this Society.

Here is an extract from a letter from Messrs. Allen and Hanburys written in reply to a medical man who wrote to ask

whether they would treat a case of lupus. "We shall be pleased to undertake the treatment of your patient for lupus, either by X-rays or the ultra-violet rays. The former treatment we have generally found more successful, but can apply either to your instructions." It is signed "for Allen & Hanburys, Limited, W. Coldwell."

This gentleman is also a member of the Röntgen Society.

Another letter from the same firm in reply to another enquiry is couched in similar terms. In it Mr. Coldwell states that the firm has had considerable success with the majority of their cases, and that any case entrusted to their care will be treated with the greatest skill and attention.

In a further letter this firm enumerate a number of leading medical men in London who have sent them cases.

Gentlemen, I believe that the Röntgen Society has exercised an injurious influence upon the practice of electrotherapeutics. By its constitution it cannot be a medical society, for in its rule on the qualifications of members it merely specifies that candidates for membership must have shown some scientific interest in the subjects dealt with by the Society; while among the objects of the Society stands the following as defined by rule 2: To study and discuss X-rays and allied phenomena in their relation to Medicine, the Arts and Sciences.

Here then we have a Society whose membership is not medical, which nevertheless proposes to discuss medical matters, a position which to my mind is improper. As a scientific body the Röntgen Society might be of great service to medical men, but I believe and maintain that the meetings of that Society are not a fit place for the discussion of medical subjects. So strongly do I feel on this point that I have ceased to be a member of the Society. An examination of their published lists of members will show the names of several persons who administer electrical treatment without any license and qualification. In support of my contention that membership of the Röntgen Society has been used as a sort of diploma by unqualified persons I would adduce the evidence of a circular addressed to the members of the Society by their Council in November last, cautioning them against such practices.

I have already drawn attention to the fact that certain of the operators and institutions mentioned above were in touch with the Röntgen Society, and I could name others. It is manifest that the Society, constituted as it is, forms a most convenient association, meeting ground and advertising medium for unqualified operators in medical electricity and renders it, in my opinion, a most inconvenient society for those medical men who object to the intrusion of the layman into medical affairs.

Gentlemen, we are not a very intelligent people in this country, and a few inconsistencies more or less do not arouse much interest here unless attention is pointedly drawn to them; but in this particular affair of the wholesale transfer of electrical treatment to outsiders, this Society must needs be interested. If it is to be altered it must be through a persistent effort on our part to make the situation publicly known to the whole body of the profession and to agitate for reform. It is our affair, and we must obtain the remedy ourselves; for if we do not take action it is quite useless to expect others, less concerned than we are, to do so for us. An inconsistency which seems to me to be a glaring one is the following. As you know, the unqualified assistant has been ruthlessly exterminated with all the rigour of the law. In his day he worked under the close supervision of his chief, attending mainly to minor points of medical practice, and he was subject to punishment by the loss of employment if he did wrong. Is it not an abandonment of the principle for which the unqualified assistant was sacrificed to countenance the unqualified electrician? Nowadays the unqualified electrician is flourishing by the support of medical men who have no close control over him, who are generally unable to prescribe the details of what they wish to be done with any accuracy, nor to form any proper judgment as to the manner in which their instructions are being carried out.

The notion of medical practice for medical men is simple and comprehensive, but its importance is not yet fully grasped by the members of the medical profession. Quite the reverse. There are plenty of members of our profession who support unqualified electrical operators. I believe that the majority of the electrotherapeutic work done in London is done by laymen. I hear of it continually. I have here, for instance, a letter from a Fellow of the Royal College of Physicians asking me to give him the address of an unqualified person to do electrical treatment.

Here is a case which seems to me to deserve your serious consideration. A medical friend of my own, whose experience of X-ray therapeutics is extensive, was consulted by a patient with a rodent ulcer. The patient said that he had been under the care of a gentleman who is surgeon to a large London hospital which has a good electrical department. He further said that the surgeon advised X-ray treatment and recommended him to apply to Messrs. Allen & Hanburys. The patient did so, but without benefit, and after a while came to my informant to ask him to undertake his case, and further asked for a reduction of fees on the ground that he had been already put to great expense for the unsuccessful treatment given by the chemists.

A few years ago a physician writing on medical electricity indulged in a sneer at the expense of medical men practising electrotherapeutics, by suggesting that they were more versed in the intricacies of their apparatus than in the knowledge of anatomy and physiology. Where are we now? The knowledge of the apparatus seems to be the only thing looked for, by those at least of our profession who support the unqualified electrician.

In my opinion the least skilled medical man is to be preferred to the most elaborately-equipped of lay electrotherapeutic operators, simply because he is a medical man, has had the education of a medical man, and feels the responsibilities which belong to every right-minded medical man. To my mind the conversion of medical electricity into a branch of work for electricians would be the greatest possible mistake.

It is often said, though chiefly by interested persons, that the equipment of the quack is so much better than that possessed by the medical practitioner; that the latter must be at a hopeless disadvantage. I mention this in order to contradict it. It is not true for one moment. There is no genuine or useful electrical appliance which is not possessed by the medical men who practise electrotherapeutics. If the unqualified man has nickel-plated knobs to his instruments where the medical practitioner is satisfied with plain brass, does that make the former apparatus any the better? As you are well aware, all the modern apparatus in use to-day is made to stock patterns in considerable quantities, and can be bought ready made at the instrument makers. From what little I have seen of the interior of the unqualified man's treatment rooms, and from photographs of other places which have been shown to me, I can unhesitatingly contradict the statement that the unqualified men have any monopoly of the best things.

It must also be remembered that the consequences of electrical applications in the hands of non-medical persons may be disastrous. I have authentic information of a fatal X-ray burn produced in the treatment of cancer by an unqualified operator. Some time ago I gave evidence at an inquest upon another case in which a photographer had caused X-ray burns in a patient with a fatal result. I have lately heard (but without full details) of a gentleman with heart disease who died a few minutes after taking an electric bath, given on the recommendation of an eminent physician by an unqualified person; and of another gentleman who developed an attack of herpes zoster in an area which had been severely faradised for half an hour by an electrical quack.

I have no doubt that members of this Society could further multiply instances of this kind.

The effect of the neglect of electrical methods of treatment in this country is already reacting very unfavourably upon the medical profession itself. Consider the electrical departments of the larger London hospitals. Are they a credit to the hospitals or are they not? Emphatically they are not. Men of the best stamp—men, that is, of the class who are willing to take up work in other special departments of hospitals, are unwilling to take up electrotherapeutic work because they do not find its status good enough. They are almost afraid even to be associated with electrotherapeutics.

At the time of the founding of this Society some members of your Council wrote to friends who were engaged in or might be interested in electrotherapeutic work to ask them to co-operate in the formation of a strong Society. It was disheartening to learn from the replies of some of those gentlemen that they feared to identify themselves with medical electricity lest it might injure their professional prospects.

If evidence were needed to show the condition of our London electrotherapeutic departments it could be found in abundance. I quote an extract from the Official Bulletin of the French Society of Electrotherapy. It is contained in a letter addressed last summer to the Secretary of the Society by a delegate who was asked to report on electrotherapeutics in England. He says of one of the largest London hospitals:—"The electrotherapeutic department seemed to me to be somewhat primitive in its organisation, and in its apparatus, and I have doubts of its being of any great utility." At another large London hospital with a medical school there is no electrical department, and the reason for this is that the staff have been unable to induce any of their qualified men to take it up.

You are probably well aware that X-ray photography and X-ray therapeutics are entrusted to lay operators at several of the London hospitals. This, I think, supports my contention that where electricity is concerned the medical profession is a little careless of its rights and its responsibilities. It does not seem to me that a proper degree of consideration is shown to patients, however humble they may be, if they are made to uncover themselves and expose their infirmities before a lay operator under the false impression that they are in the hands of a duly qualified medical man.

There are two very important points which must not be lost sight of in considering the position of affairs. There is a clear distinction between the mere quack and the more or less carefully trained electrician. The latter class tends, of course, to shade off into the former; but the difference is there, and must be recognised. For instance, the letters of Messrs. Allen & Hanburys from which I have quoted are proper

letters in every way, save only that they give evidence of an extensive invasion of the rights of medical men by unqualified persons. The fault is quite as much a fault of the medical man who sends his cases to an unqualified operator, as it is an unjustifiable invasion of the medical field by those operators. It is the former who are guilty of the technical offence of "covering," which is so severely dealt with when it is not a matter of electrical treatment.

Our difficulty to-day is not so much the old, and still present one, of the common impostor, but the new difficulty of the invasion of medical practice by laymen who treat cases medically, and do it with the support of members of the medical profession.

The other of the two important points we must remember is this: We must by no means denounce too hastily the medical men who employ lay operators, nor be too ready to impute prejudice or any other unworthy motive. I am sure that harm done is done from thoughtlessness or sheer ignorance. I saw a letter only last week, written by a medical man in the country to another in London. It said that a patient of his had fallen into the hands of a quack in London, and he wanted advice as to how to extricate him from his clutches. He did not know, he wrote, of any one in London to whom to entrust his patient. The profession at large does not know that there is any systematic study of electrotherapeutics by medical men. They do not know who is a competent exponent of this branch of therapeutics or who is not. They read the copious advertisements of the numerous electrical institutes; they see the phrase "solely under medical direction" which these establishments use so lavishly, and they take for granted that things are all right. It is for us to educate the medical profession in this matter, and in order to succeed we must show by our deeds and by our writings that there exists a body of medical practitioners who take electrotherapeutics seriously and are worthy of confidence. Gentlemen, we number 140 members, our numbers are rapidly growing, and it is for us to devote our energies and our money, both individually and collectively, to the rescue of electrotherapeutics from its threatened dangers. It is high time to begin.

Dr. DONALD BAYNES proposed and Dr. W. S. HEDLEY seconded a hearty vote of thanks to Dr. Lewis Jones' address.

The meeting then concluded.

NOTICE.

Members are reminded that the subscription (one guinea) for 1904 became due on January 1, and should be sent to the Honorary Secretary, 20, Bedford Square, W.C.

Digest of Current American Literature.

DIETARY TREATMENT OF CONSTIPATION.

According to Hewes two general propositions are to be borne in mind in the treatment of Constipation. (1) Some definite pathological lesion or condition, such as obstruction of the intestine, lesion of the nerve mechanism or its function, or general disorder of metabolism; or (2) a faulty condition of hygiene as a result of which the natural stimulants of the physiological function are lacking. In either instance the hygienic treatment of the constipation is of first importance. To this end it is necessary (1) to have a regular time for defecation; (2) to take a proper amount of physical exercise; (3) a proper diet. The amount and kind of food needed for a healthy existence is to be fixed by the number of calories required in 24 hours. In addition it is important to select foods which are active in promoting peristalsis. These may be classified according to the way in which they act;—(*a*) foods that act by reason of non-absorption if given in excess (fats), or those containing a large amount of residue which acts mechanically (vegetables); (*b*) foods liberating organic acids or other substances which either locally or by absorption increase intestinal activity,—(tamarinds, prunes, plums, for example); (*c*) foods undergoing fermentation in the intestine with the formation of organic acids (carbohydrates).

To an ordinary mixed diet, there should be added a sufficient quantity of food, which, either by its indigestible residue, its contained organic acids, or its proneness to fermentation, will produce local or reflex irritation sufficient to cause the bowel to expel its contents.—*Boston Medical and Surgical Journal,* September 17, 1903.

The following apparatus which appeared as part of Messrs. Isenthal & Co.'s exhibit was inadvertently included in the exhibit of another company:—

New pattern horizontal high frequency apparatus with silent spark box and new adjustable solenoid with fine hand adjustment.

New pattern vertical high frequency with silent spark box, and fitted with two sets of Leyden jars of differing capacity to interchange.

Skiameter, with eight varying thicknesses of platinum and movable screen, arranged so that the penetration of vacuum tubes may be adjusted and compared.

The ægis synchronous motor rectifier, for working X-ray apparatus direct from the alternating mains.

MEDICAL

Electrology and Radiology.

No. 3. MARCH, 1904. Vol. V.

EDITORIAL.

The valuable paper entitled "Resemblances exhibited between the Cells of Malignant Growths in Man, and those of Normal Reproductive Tissues," which was contributed by Professor J. B. Farmer, and Messrs. J. E. S. Moore and C. E. Walker, and read before the Royal Society on December 10th of last year, is of great interest to all engaged in the study of the etiology and treatment of malignant disease. Viewed in the light furnished us by Caesare's still earlier observations "Upon the Effects of Radium Radiations upon the Nuclear Mitosis of Germinal Epithelium," it affords us an additional clue to the lines upon which the successful treatment of this scourge of humanity can be met and conquered. Without entering into a discursive dissertation of the intra-nuclear changes that take place in the division of the cells themselves, and without wearying the reader with full abstracts from the papers in question, it is well to notice the data that these two papers afford us. From the former we learn that the mode of nuclear sub-division in the majority of cells that characterise malignancy closely simulates, if it is not identical with, the mitotic changes that are found in developing reproductive tissues: from the latter we gather that radium radiations exert an unquestionable inhibitory influence upon mitosis, and no advance towards "hetero-type mitosis," can be observed in the cellular nuclei. Although a difference of opinion may exist as to the exact bearing of the facts communicated, it is evident that these views may be the means of directing much of the energy now wasted in fatuous research into certain channels, that hold out a fair promise that assiduous research will eventually be crowned with success.

The radio-activity of organic substances still appears to be the centre of scientific interest. Recent experimental observations seem to establish the following conclusions. This property is in nowise the peculiar attribute of the nervous and contractile tissues of warm-blooded animals. The degree to which the phenomena are manifest is co relative to the character of the normal idio-muscular contractions, being proportionate to their rapidity and energy. The same is to a lesser extent noticeable in inanimate bodies, in which the

processes of natural resolution into simpler compounds are retarded by artificial means. These discoveries afford us a rational explanation of the "corpse-lights," said to have been noticed upon opening up ancient graves, and of "Od" force so widely discussed in the early eighties.

PRACTICAL LESSONS IN THE TREATMENT OF AFFECTIONS OF THE GASTRO-INTESTINAL TRACT BY ELECTRICAL METHODS.

By George Herschell, M.D., Lond.

(*Continued from page 76.*)

Treatment of Gastric Neurasthenia by means of Sinusoidal Currents.

Of all the forms of electrical treatment the one which will usually be found to produce the best results in gastric neurasthenia is the alternating sinusoidal current applied to the patient either by means of the hydro-electric bath, or by the direct application of electrodes to the surface of the body. For this purpose we may make use of the ordinary monophase alternating current or we may employ currents having a triphase relationship. As is well known, I am a strong advocate of the latter, as I believe that the change of sign which occurs in rotation in the three electrodes renders the current more stimulating, and also that by applying the electrodes in a suitable manner we can subject a given zone of the patient's body to a most intense and penetrating electrical action. But whether we elect to make use of the monophase or triphase current, there are several very weighty reasons why it should be derived from a motor-generator group or from a rotary converter and not from the house main. The chief of these are the following:—

1. We shall have the means of controlling the rapidity of phase.

This is a most important point, since, as far as we know, the therapeutic effects of high and low periodicity differ considerably. With high periodicity we must of necessity have a short charge, a small zone of action, and, owing to the frequency of the reversals, comparatively little penetrative power. The action of the current will in consequence be mainly confined to the skin and superficial parts. With a low periodicity, on the contrary, we have the effective zone extended and greater penetrative power as the infrequency of

the reversals will allow time for the current to act upon the tissues. We shall thus be able to act upon the muscles and deeper structures with a current of less intensity, a point of importance insomuch as less pain and discomfort will be produced. Whilst with the current from the house main we have absolutely no means of controlling the periodicity, but have to take what the company choose to send us, and be thankful; with a rotary converter by means of a suitable brake upon the armature we can practically impose any periodicity we wish upon the current. At the same time we can maintain a constant output by simultaneously reducing a variable resistance in the primary circuit of the machine.

2. It is not safe to use the current from the main as supplied by the companies, as it is their custom to lower the periodicity once at least during the day without notice. This is notoriously the fact in the case of one particular company, who have three machines respectively, giving 100, 82 and 60 periods per second.

We have then to face the fact that transformers wound for a high periodicity are dangerous on a low one. The reason of this is that the number of ampère turns of a calibre of wire efficient on a high period would heat up on a low one, and allow too great a quantity of electricity to be generated in the secondary of the transformer. And if this happened whilst the patient was in the bath the consequences might be most unpleasant. The points in favour of using the current from rotary converter may be briefly stated to be: control of period, control of dosage, safety of apparatus, safety of patient against earth currents, the possibility of using one, two or three phases in a full bath or in a two, three, or four-cell bath, the facility with which the current can be measured on commercial moving magnet instruments, and the ability to produce localized zone effects which would be dangerous from the main.

If, however, notwithstanding, we elect to use the current from the main with the full bath we must take care, (*a*) That the bath is of porcelain or teak; (*b*) That its outlet is connected to the drains not directly, but by the interposition of a short length of rubber hose; (*c*) That the bath itself is raised from the ground on porcelain feet or glazed bricks; (*d*) That the water taps do not touch the bath; (*e*) That the alternating main is led to the transformer through lamps; (*f*) That the secondary of the transformer has a 0·1 ampère fuse in circuit with the bath; and (*g*) That the transformer has a zero point.

The technique of the full sinusoidal bath with monophase current is so well known that it needs no further description from me. It is important to remember that the bath electrodes should be as large as possible, mobile, and incapable of metallic contact with the patient, that the bath must never be filled or

emptied when the patient is in it and the current turned on, and that no salt must be added to the water in the bath.

The average dose for a neurasthenic patient would be 20 milliampères, one electrode being at the head and the other at the foot of the bath. As a matter of fact a current strength should be used which is comfortable to the patient and which is not strong enough to set up muscular contractions.

Three baths a week will probably be found to produce the best results, and the course should extend over a couple of months if the patient is found to derive benefit from them. It is important as a matter of routine to take a sphymographic tracing of the pulse before and half an hour after each bath, and to have the urine tested quantitively for urea and uric acid at regular intervals during the treatment. We shall then be in a position to form a judgment as to the benefit which the patient is deriving by noting the effect of the baths upon the pulse tension and upon the metabolism of the body. As regards the temperature of the bath, we should make it a rule to give it as cold as the patient can stand without discomfort and subsequent chilliness. It is a good plan to give the first bath at 90° Fahr. and reduce the temperature by one or two degrees on each occasion. In like manner the patient should not remain in the first bath longer than five minutes, the time being extended by two or three minutes, until at the termination of the course a bath of perhaps 75° to 80° is being taken of 15 minutes' duration.

In giving a triphase bath it will be found convenient to place one electrode at each end of the bath and one suspended above the abdomen of the patient.

In general practice it will be found that the easiest manner of administering the sinusoidal bath is by using two or three vessels containing water into which the legs and arms of the patient are placed. Such an arrangement is termed the "series cell bath," and may be connected to the poles of the generator in several different manners. These have been described by me elsewhere and need not be repeated here.*

The best arrangement for the treatment of gastric neurasthenia is, I think, to have the patient's legs in a bath connected to the first pole of the triphase generator, his arms each in a bath connected by a bifurcated rheophore to the second, whilst a large flat wet electrode attached to the third pole is placed upon the abdomen, or upon the spine.

In cases where it is not convenient to make use of hydroelectric baths, very good results may be obtained by the direct application of the triphase current to the surface of the body in the manner suggested by Guimbail,† who utilizes the

* Polyphase Currents in Electrotherapy. London 1903,

† *La Thérapeutique par les agents physiques.* Paris. Baillière, 1900, p. 35.

anatomical fact that in the dorsal region the sympathetic chain of ganglia is particularly accessible to the current, lying as it does behind the pleura just in front of the costovertebral articulations.

For this application we require three electrodes, one about 4 × 5 inches in size and two others 2 × 10 inches. Each of these electrodes is attached to one pole of the triphase generator. The two long narrow electrodes are placed one on each side of the vertebral column in the dorsal region, and are kept in position by the weight of the patient who lies upon them on a couch. The third electrode is placed upon the epigastrium, and retained in position by a bag of large leaden shot or by the patient's hand. The triple rheostat in the patient's circuit having been placed at zero, the machine is started and allowed to run at a medium speed. The resistance is now gradually taken out of the triple rheostat by turning the handle until the current can just be felt by the patient. It is now gradually increased until the point is reached when it ceases to be pleasant. This is the correct dose, and should be continued during the session. At the termination of the treatment one must be careful not to suddenly switch off the primary current or the patient will receive an unpleasant shock; but slowly move the rheostat to the zero point, then you can turn off the current and stop the machine.

The duration of treatment should not exceed three minutes on the first application, and may be gradually increased from day to day until the current is given for 15 minutes. Treatments should be given every day for a couple of weeks, and then three times a week for some considerable time.

Treatment of Hyperchlorhydria.

We owe the electrical treatment of this condition to Dr. Boardman Reed, of Philadelphia, who established the fact that the secretion of hydrochloric acid in the gastric juice could be readily reduced by the intragastric application of a high tension induction coil current. By this is meant the current induced in a secondary wound with at least 1,000 yards of No. 36 wire; the test of the efficiency of the current being the fact that it will glow and stratify a Geissler tube. The apparatus required for this method of treatment are a suitable induction coil apparatus, an intragastric electrode, and a flat electrode of 12 to 16 square inches in area with suitable rheophores. One of the Kidder pattern sledge coils is to be preferred, as this possesses a rheostat in the primary circuit and a system of switches, by means of which different lengths of the secondary windings can be selected and brought into use. The best intragastric electrode at present on the market is that devised by Boardman Reed himself,

and for the external electrode the one described on page 74 is quite suitable.* The passage of the intragastric electrode, which consists of a flexible insulated stem terminating in a metallic bulb covered with a perforated vulcanite sheath, will present no difficulty as the patient will already have had an ordinary stomach tube inserted for purposes of diagnosis, and will be more or less accustomed to the process. The technique is as follows:—The patient first of all drinks a large glass of water containing a little bicarbonate of soda. He then sits upon the edge of a couch, and unfastens his clothes in front so as to expose the surface of the abdomen. The electrode is then passed into the stomach, and the patient lies down upon the couch. The large flat electrode, well wetted, is now placed upon the epigastrium and kept in position with a bag of shot, or held by the patient himself. All connections between the electrodes and induction coil having been made, and the secondary coil having been entirely withdrawn from the primary so that no current will pass to the electrodes, the rapid interrupter is switched into the circuit and the coil started. The rheostat in the primary circuit and the spark gap of the interrupter are now to be so adjusted that a fine rapid interruption is set up without spluttering or any unevenness. The secondary coil is now moved over the primary until a current is induced which will be just short of that required to throw the abdominal muscles into contraction. This is the correct dose. After the current has been allowed to pass for five minutes the flat electrode is moved from the epigastrium to the back of the thorax over the lower ribs and retained there for a short time. The current is then gradually to be reduced to zero and the patient allowed to sit up. The intragastric electrode must now be removed from the stomach. In doing this, it will usually be arrested at the cricoid cartilages; when this occurs, the patient must be made to swallow once or twice, and at the moment when the larynx rises, the electrode may be readily removed. For the treatment of hyperchlorhydria a daily application of electricity in the manner described will be necessary for two or three weeks. After that, three times a week for another three weeks will usually complete the cure. Of course, at intervals during the treatment a test meal must be given, and the stomach contents examined quantitively for hydrochloric acid, to mark the progress which the patient is making towards recovery.

(*To be continued.*)

---

* These may all be obtained from A. E. Dean, 82, Hatton Garden, who is also prepared to supply the cells for the series hydro-electric bath.

ON THE METHODS OF APPLICATION OF HIGH FREQUENCY CURRENTS.

By Clarence A. Wright, F.R.C.S., E., &c.

(Continued from p. 72.)

Cataphoresis by High Frequency.—This is a modification of stabile bipolar derivation, introduced to facilitate local medication. It is essential to a proper understanding of the subject to consider at some length the phenomena of electric osmose.

The Phenomena of Electric Osmose. — It has long been known that an electric current in passing through the liquid contained in a small vertical tube, into which two platinum wires have been fused, causes the level at which the liquid stands to be raised, when the current moves in an upward direction. This peculiar effect seems to be due to a mechanical current, whose direction corresponds with that of the electric flux and whose velocity is determined by its intensity, while the height to which the liquid is raised is proportionate to the cross-section of the containing tube. As somewhat similar effects are noticeable even when the tube is placed in a tank, through which iced water is kept circulating, it is evident that the phenomenon is not entirely due to the heat engendered by the passage of the current. Reinold and Rücker have noticed a somewhat similar phenomenon. When an upward current is passed through a perpendicular soap film it greatly retards, if it does not entirely arrest, the thinning of the film. Porrett observed that when a strong current was led into the liquid contained in a Daniel apparatus— a U-shaped container fitted with a porous diaphragm between the electrodes—a mechanical current is set up, which by forcing a part of the fluid through the central partition causes the liquid to attain a higher level on the kathodic side of the diaphragm than on its anodic side. The degree, to which this phenomenon, known as *electric endosmosis*, is manifest, depends on the conductivity of the fluid and the specific dialytic capacity of the diaphragm for the liquid. With fluids that are bad conductors the phenomenon is more easily demonstrated than with those of good conductive capacity ; at the same time it must be remembered that one that readily saturates the diaphragm is most readily passed through its pores. Closely allied to the preceding phenomenon is that known as *electric distillation.* Although Baccaria had previously noticed that an electrified fluid evaporated more quickly than an unelectrified one, yet it was Gernez who first demonstrated this apparent distillation. He employed a bent glass tube connecting two small glass globes, into which the platinum electrodes had been fused. When

liquid was introduced so that it stood at the same level in both globes and an electric current was passed through it, it was noticed that the fluid passed over from the anodic container to that connected with the kathode. This phenomenon cannot be attributed to any difference in temperature or extent of surface exposed ; but to a slow creeping of the fluid along the inner surface of the connecting tube or, in other words, to a sort of electro-capillary syphonage. Quincke, on the other hand, discovered that an electric current is set up when a liquid is forced by pressure through a porous diaphragm, the E.M.F. of the current so induced being proportionate to the pressure and to the dialytic affinity of the diaphragm. "If Porrett's experiments," says Reus, "be repeated with a fluid, which is kept circulating through the porous diaphragm of a Daniel apparatus by pressure (that in one arm being subjected to a positive pressure by means of an air pump, while a negative pressure is produced in the other by creating a partial vacuum), the rapidity with which the fluid passes through will be found to depend on the direction of the electric flux. It is increased when the direction of the electric flux and of the current coincide and is diminished when they are opposed to each other.

"If instead of a simple fluid a standard solution of two or more salts be employed, it is found that the relative proportion of each in the dialysed fluid varies considerably from that of the standard solution. The amount present depending on (*a*) the specific diffusibility of the salt ; (*b*) the degree of its saturation in the standard solution ; (*c*) the nature of the diaphragm ; and (*d*) the duration of the electric flux. When two diaphragms are employed and the direction of the current periodically reversed the pressure of the liquid in the central compartment steadily rises and causes the diaphragms to bulge outwards. Quantitive analysis of the fluids between and on either side of the diaphragms then shows that the percentage of the different salts present in the samples taken from each of the three compartments differ not only among themselves but also from that in the standard solution. This peculiar property of alternating currents is a point of great economical interest ; as it affords a ready way of separating alkaloids and other active principles, both animal and vegetable. It also furnishes a clue to the method to be employed in obtaining gold from sea-water, the question largely turning on the use of suitable diaphragms. More closely connected with electrotherapy is the explanation it affords of cataphoric phenomena and the movement of the ions on the one hand and the resolution under electric treatment of tumours and chronic indurations on the other."

It is this peculiar property of alternating currents that is utilised in the cataphoric treatment of disease by high fre-

quency; an electric transference being thus effected of the substances dissolved in the fluid conveying the current through the interstices of the tissues, which appear to act like a series of diaphragms interposed between the electrodes. An explanation of the way in which these results are obtained is afforded us by the experiments of Tommasi and Thomas Tommasina. These show that the transmission of an electric impluse by an electrolytic conductor is accompanied by a transference of substance, which manifests itself by the formation of arborescent chains of deposits between the electrodes. These follow the natural lines of force of the electric field. Although it had long been known that the absorption of mediciments by the skin could be greatly increased by electric action* yet it was not till the year 1890 that this method of medication attracted any real attention. The electro-chemical researches of Foveau de Courmelles was the first attempt to treat the subject from a scientific standpoint. His researches proved that cataphoresis was not simply a question of increased cutaneous absorption but of real penetration and particulate transference of the molecules of substances held in solution in accordance with certain regular laws. The best known of these are coupled with the names of Faraday and Kohlrausch. These substances pass into the tissues of the body, many of which appear to act as porous diaphragms interposed between the electrodes. According to Leduc the flux of force in electrolytes is made up of a double current of ions, an ascending stream of anions flowing towards the positive pole, and a descending one of kathions moving in the opposite direction. Leduc has also, by means of coloured ions—a solution of permanganate of potash—been able to prove that these substances do not merely pass in the subcutaneous areolar tissue; but directly penetrate in glandular and other organs more deeply situated. Frankenhauser has shown that the amount of medicament absorbed and the depth to which it penetrates bear a constant relation; the former to the quantity, the latter to the intensity of the current employed. He has also found that the anode is instrumental in effecting entrance into the tissues of acids, metallic salts (other than those of the fixed alkalies and alkaline earths) and the salts of the alkaloids, while at the kathode the fixed alkalies, the alkaline earths and their basic salts are absorbed.

Cup electrodes are those most commonly employed in cataphoresis. The electric bath has been used by Apostoli,

* This was first demonstrated by Pivati in 1750, who employed a static charge for the purpose; again in 1873 by Arthuis with electricity from the same source. In 1885 Lauret first utilised a continuous current in electric cataphoresis.

Laquerriere and Schnée. The method of Phillips and Aidy has also been successfully tried.

Reaction.—This to a great extent depends on the nature of the mediciment employed. Mineral acids cause a dissolution of the skin and tissues. The metallic salts give rise to necrosis when used in concentrated solution. Water has a purely stimulating effect, which varies with the intensity of the current. Iodine, salicylate of soda, the salts of lithium, and pilocarpine exert their own specific effects upon the parts to which they are carried. Leduc by this means has been able to reproduce every variety of lesions which cutaneous affections manifest.

The names of the diseases amenable to treatment by this method is legion. Bordier first employed the salts of lithia in gout. Destal and Labutut in 1893 discovered by spectrum analysis the characteristic lines of lithium in the urine of patients treated with lithia by this method.

Iodine in both aqueous and alcoholic solutions has been used in goitre, tertiary syphilis, tabes and myelitis. Simple and medicated solutions have been employed in gynecological practice to control hæmorrhage, abolish pain and promote the resolution of exudates, hæmorrhages and tumours. In arthritism, both of traumatic, rheumatic and specific origin, iodine, salicylate of soda, and the essential oils of wintergreen and Japanese peppermint have proved useful. Cocaine has been used in dental practice and minor operations. Lecithin, cacodylate of soda, and preparations of guaiacol and of cinnamic acid have been tried in phthisis.

Graduation.—The intensity of the current has an important effect on the results. It is usual to start with a current of 40 m.a. and gradually increase it to 720 m.a. The flow of the current is controlled by the same methods of regulation as in stabile bipolar derivation.

Duration and Frequency of Sessions.—This depends to a great extent on the nature of the mediciment, the strength of the solution, the intensity of the current and the reaction produced. A session usually lasts from 4 to 20 minutes. Smaller doses of the drug and more dilute solutions are needed to produce local effects as well marked as when the drug is administered by the mouth. For instance, a four-minute session with two per cent. solution of salicylate of soda effectually subdues the pain in rheumatism, specific arthritis and synovitis, while six applications of a 4 per cent. solution of iodine for 10 minutes at a time has brought about the absorption of a gumma of the frontal bone and relieved headaches in a case of specific disease which had long resisted treatment by other methods.

REVULSIVE BIPOLAR DERIVATION.—This method of application was introduced by Marie of Toulouse. In it the patient is connected by two flat discs or moist tampons with the opposite poles of the small solenoid or of a bipolar resonator. The shunt circuit thus established is interrupted by a miniature spark gap inserted between one pole of the solenoid and the rheophore applied to the body of the patient.

Reaction.—As the patient in derivation is not only influenced by the vibratory current derived from the small solenoid or resonator, but also by the electrical oscillations set up between the discharging knobs of the miniature spark-gap introduced into the circuit, the reaction produced varies from that of simple stabile bipolar derivation. Marked muscular contractions are produced which are less painful than those caused by the magnetic induced currents. This revulsive reaction may be employed in all cases where it is desirable to elicit neuro-muscular contractions.

Graduation.—By altering the distance between the discharging knobs of the spark micrometer a certain measure of control of the degree of sensible muscular reaction can be obtained. The substitution of a multiple spark gap, (like that used by Rollins and Williams in radiographic work with a static machine,) for the miniature spark gap extends the limit of control.

Duration and Frequency of Sessions.—This in a measure depends on the tolerance of the patient. Although powerful muscular contractions can thus be produced, yet it is extraordinary how rapidly the majority of patients become habituated to this reaction and cease to complain of pain even at the first session. For the treatment of atonic conditions of the stomach and intestines (as dilatation of the stomach and constipation) a session of two to five minutes is sufficient to commence with. Treatment seldom extends beyond 10 minutes at a time, and the sessions are repeated on an average three times a week.

Labile Bipolar Derivation.—This method of continuous direct applications occupies an intermediate position between stabile bipolar methods and treatment by effluvation. It consists in connecting the patient by means of one *fixed* and one *movable* electrode with the two terminals of the solenoid of high frequency. The electrode used to massage the part must be a simple metallic electrode and *not* a condenser electrode. In this method of application, although contact is continuous and the individual parts of the skin only in momentary contact with the moving electrode, still a certain amount of cutaneous erythema and revulsive reaction are pro-

duced. For however well maintained contact between the skin and the curved surface of the electrode may be, still it can never be intimate at all points, so that a certain amount of sparking naturally takes place between them. This not only excites fibrillar muscular contractions but also has a heating action on the surface of the electrode which grows unpleasantly warm when the session is prolonged, or when used with a current of great intensity. This effect is more noticeable with the globular and T-shaped cylindrical electrodes than with a roller, as the revolutions of the cylinder allows a little time for the surface to cool before being again subjected to the heating action of the current discharge.

Reaction.—In this method of treatment the revulsive effects of the current-discharge are superadded to the general systemic and local concentrative reaction of stabile bipolar derivation. The local reaction varies from a slight erythematous blush to a true vesication or necrotic ulceration; the latter effect being most liable to be produced when sparking is particularly powerful and the session unduly prolonged or repeated too soon to the same spot. This method has been with advantage applied to the treatment of atonic dilatations of the intestinal tract, and of the bronchioles also in constipation; but for the last mentioned condition the method of Marie of Toulouse has in my hands proved more effectual.

Duration and Frequency of Sessions.—These vary with the nature of the case. When the surface over which the electrode must travel is extensive the sittings naturally are longer than when treating a more restricted area. The tolerance of the patient and the local reaction are the best guides as to frequency of repetition. It is unwise to subject a part, while the reaction persists, to further treatment. The sessions as a rule seldom extend beyond 12 minutes, and are repeated not oftener than three times a week.

INTERRUPTED BIPOLAR DERIVATION.—In this variety of labile applications the flow of the current is, as its name implies, interrupted by the movement of the electrode over the surface of the skin. The rheophore employed is either a brush or a series of small brushes mounted concentrically or in parallel rows on a common connecting handle.*

* I have lately experimented with a smooth-faced metal electrode (after Erb's model), formed of 400 well insulated wires to the square inch. When this is applied to the skin no prickling from surface inequalities are noticeable, but when the current is turned on the individual wires soon make themselves felt. This electrode is easier manipulated and controlled then any form of brush electrode.

Reaction.—This depends to a great extent on the rapidity and degree of interruption and the intensity of the sparking set up. As would naturally be supposed the local reaction is proportionate to the degree of interruption. Even apart from this, the local effects are marked ; as the density of the current, owing to the limit surface for contact, is great and causes a general heating of the wire points in contact with the skin. An erythematous blush is therefore often seen extending for more than half-an-inch beyond the actual seat of the application. In addition to the cutaneous erythema the interruptions of the current give rise to neuro-muscular contractions in the subjacent contractile structures.

Graduation.—The effects can in a measure be regulated by varying the self-induction of the direct circuit and by a judicious selection of brushes made of wire of suitable thickness.

Duration and Frequency of Sessions.—The amount of local reaction must guide the operator in fixing the duration and frequency of the applications. It must, however, be remembered that the reaction seldom attains its full development until four or five hours after the termination of the session. These should not therefore be unduly prolonged. One of two to six minutes' duration is for most cases generally considered sufficient. They seldom bear repetition oftener than twice a week.

(To be continued).

Amongst the notices of firms who exhibited at the Annual Meeting, we regret that owing to an oversight no mention was made of the exhibit of Lemmon & Co., 19, Hanover Square, W. A very notable feature of this exhibit was the display of various types of cystoscope for examination, catheterization, irrigation, etc., which fitted with the cold lamp seemed to show a distinct advance in the endoscopy of the bladder. A motor for trephining and for vibratory massage attracted notice, as well as portable accumulators for light and cautery. An aero-urethroscope possessed many excellent features. A solid glass rod lamp for examination of cavities had two excellent points in being absolutely cold and projecting the whole of the rays from the end. Head lamps, hand lamps, lamps for endoscopic purposes, and for general illuminations were to be seen in great variety, and of excellent construction. Switch boards, induction coils, and indeed apparatus covering the whole field of electrotherapeutics were on view, and bore evidence of first-rate workmanship.

1904.

By Dr. W. S. Hedley.

(Continued from p. 84.)

Heat and its Therapeutics.

Some years ago I showed before the Balneological Society an apparatus devised for applying to the body direct heat rays from a luminous source. It consists of incandescent lamps, (each carrying 2½ ampères of current) fixed in reflectors. This method has stood the test of time, but clinical experience has taught us some further lessons in connection with its employment. I ventured to say then that when the heat is from a luminous source a comparatively low temperature only is required to produce diaphoresis. This is fully confirmed; therefore instead of using the recumbent bath with broad filament lamps carrying powerful currents, we now employ simply a cabinet filled with a number of ordinary incandescent lights. If, on the other hand, there is required not only a sudorific, but a powerful "counter-irritant" or "sinapism effect," the higher temperature and the heavier currents are necessary. It is not difficult to conceive how cutaneous nerves thus stimulated over a wide extent of surface, send co-extensive ingoing impressions to nervous centres, impressions that are reflected thence to various internal organs (with which special cutaneous areas are known to be in direct neural communication). Another practical lesson that I think I have learnt is that in addition to the dilatation of the cutaneous vessels, the diaphoresis, the revulsive effect, the absorption of exudation by long sittings, there seems to be a direct stimulation to nutrition by short sittings. In other words, a radiant heat and light bath of short duration acts as a "tonic." The third and not the least important lesson to be learnt is, that although the incandescent light bath is on the whole better tolerated than any other diaphoretic procedure, there is an acceleration of the pulse rate and a diminution of blood pressure which must be reckoned with, especially in persons with a feeble heart.

I have seen it stated even in medical publications that unless a patient is treated at 300° to 450° Fahr. he is "not getting his due." If this means that the human skin can tolerate such a temperature we, of course, know such a statement to be incorrect.

Light.

The question of heat from a luminous source brings us to the borderland of photo-therapeutics. Now, although diaphoresis is most easily produced when the heat is from a luminous source, still I think this is the direct result of the calorific rays, because if an arc lamp is used (where the

chemical rays are in greater relative number) the sudorific effect is less.

Bactericidal effects have been claimed for the arc lamps, and this is doubtless true in the case of powerful arcs, but Krebs (*Zeitschrift für Diät. und Physikalische Ther.*) seems to have proved that the arc lamp using five ampères of current, such as is used in the ordinary electric light bath, have practically no effect on the micro-organisms of the skin; and even in the case of lamps taking 60 to 75 ampères, Freund has found that no bactericidal action occurred when such rays passed through living tissue. The ear of a black rabbit was stretched between the rays and a plate culture of staphylococcus pyogenes aureus. The culture was placed in the incubator after an hour's exposure, but next day was found to be covered with colonies of bacteria. The same experiment was performed with the ear of a white rabbit and also with the ear moistened with adrenalin, with the same negative result. In all three cases inflammation of the exposed ear developed in 24 hours.

But all this is far from saying that the full radiant energy of the arc is without effect on the interior of the body. It is the opinion of some observers that light represents a fact of enormous importance in the treatment of consumption, especially through the chemical end of the spectrum. Dr. Cleaves, of New York, who has made extensive use of all the radiant energies of the arc, has always suggested that influences other than the chemical rays are active. It may be that, to get an effect upon the deeper tissues, rays of large wave length are necessary, just as in the case of sound the deeper tones with large wave lengths are conducted over longer distances, and through greater obstacles, than the higher tones. It would thus appear that between the effect of luminous heat pure and simple—the domain of the incandescent light bath, and the chemical rays—the land of Finsen, there is a range of radiation which is well worth investigation, and which has some claims to therapeutic effects; but those claims cannot yet be considered fully proven.

Coloured Light.

Dividing up the spectrum and using its various components, Freund is of opinion that acne vulgaris, ulcers of the legs, etc., are favourably influenced by long exposure to intense red light. The views of Finsen with reference to its employment in small-pox are well known; he considers that it acts by the exclusion of the ultra-violet rays, which are the cause of pitting; and the opinion is supported by much experimental evidence and 150 cases. Schamberg (*Journal of Am. Med. Assoc.*, May, 1903) considers that there are numerous facts which militate against this view; but he brings only two cases and some theoretical considerations to his support. It was reported by a member at a recent meeting of the

Dermatological Society of Chicago that he had used red light in the treatment of measles and erysipelas without good result. On the other hand, Krukenberg (*Munich Med. Wochen.*) reported 18 cases of erysipelas, and thought that the fall in temperature and general amelioration of the symptoms was undoubtedly due to the exclusion of the chemical rays. He thinks that the favourable action of ichthyol, of tincture of iodine, and various plasters is explained by the protection given to the skin against the chemical rays. The negro is protected from these rays by the colour of his skin and according to certain authors is not much subject to erysipelatous and phlegmonous inflammations.

Minim considers that blue light has an action on vasomotor nerves, that it is endowed with analgesic qualities, and that it ameliorates or cures superficial neuralgias. The anæsthesia it produces he considers sufficient to perform certain small operations without pain. It also favours the cicatrisation of wounds. Kaiser observing the favourable action of light on a septic ulcer carried out further experiments, and found that (1) tubercle bacilli in pure cultures were killed in 30 minutes by a powerful blue light arc at a distance of five metres, whilst they survived the radiation of an ordinary arc; (2) Tubercle bacilli placed on a patient's back blue light being at the same time directed to the chest at five metres for 30 minutes and the procedure repeated in six days, became weakened; (3) Pure cultures of tubercle bacilli were killed when exposed to the radiation of an arc concentrated through a hollow lens, containing a solution of alum and methylene blue with ammonia; (4) When the spectrum was split up, cultures lived in red and yellow but were killed from the blue violet to the ultra-violet; (5) Photographic plates attached to patient's back (light being excluded), and the radiation sent through the patient's body, a blurred positive was obtained. Subsequently to these experiments Kaiser treated two cases of advanced phthisis with the same blue light—after six days night sweats ceased and cough became less; at the end of six weeks there was continued diminution in the number of bacilli. In tuberculous abscesses of the thigh healing was obtained in four weeks. In a tuberculous child with weeping eczema cure was established in five weeks. Therefore, in view of the foregoing experiments Kaiser thinks that blue light kills tubercle bacilli; that chemical rays can pierce the body sufficiently strongly; that blue light acts powerfully as a resolving agent and also as a local sedative; that with a sufficient current-concentration it may even produce anæsthesia.

Finsen Treatment.

Coming to Finsen and his rays we find ourselves on firm ground again. Of 800 cases treated at the Finsen Institute there was improvement in 90%, cure in 70%, reappearance in 20%, the latter being generally cases where the mucous mem-

branes were affected. Finsen seems to think that the number of cases of tubercular lupus really incurable need not be estimated as more than 2%. It is very different with L. erythematosus and epitheliomata. There are good results in alopecia areata and a small percentage of cures in acne and chronic eczema.

Measurement of Light.

The last point in the therapeutic use of light is dosage. It is evident that for its systematic application, a measuring instrument seems to be found in the actinometer. Its principle is to let the rays play upon a screen of platino cyninide of barium, and then see what thicknes of solution ammoniated sulphate of copper will cut off the chemial rays.

PERIPHERAL NEURITIS.

In a clinicotherapeutic *résumé*, Pritchard treats in detail four forms of neuritis: (1) of the facial nerve; (2) of the sciatic nerve; (3) of the intercostal nerves; and (4) of the fifth nerve. Traumatic neuritis is also considered in a subsequent paragraph.

In summing up his therapeutic teaching, the author emphasizes the following facts: (1) the importance of functional rest in all cases of neuritis, often to the extent of mechanical enforcement; (2) the value of forced nutrition, especially with fats: constitutionally, cream and butter, and locally, lanoline inunction; (3) his confidence in electricity and massage, neither of which should be used empirically and both of which require in individual cases the greatest nicety of personal adjustment; (4) in all forms of sensory neuritis, the maintenance of an equable surface temperature, best attained by the use of lamb's wool fleece; (5) the recognition of neurotic habit-tendencies and predisposition, varying widely in individual cases, but which should never be overlooked or disregarded, and which should be met with corrective nerve discipline according to the needs of the individual patient; (6) the recognition of the fact axiomatically true that all cases of neuritis except, perhaps, the traumatic and mechanical, are not only associated with, but, as a rule, dependent upon, states of altered metabolism and perverted nutrition, to which recognition the necessity of tonic, alterative, and nutritional measures is logically correlated.—*Medical News,* December 19th, 1903.

X-RAY DIAGNOSIS OF ENDOSTEAL SARCOMA.

By Edward W. H. Shenton, M.R.C.S. Eng., L.R.C.P. Lond.

Small children are apt to fall and injure themselves unknown to their parents and friends. Owing partly to their

inability to express their ideas and partly to other causes serious lesions may be present without giving evidence.

Such cases are commonly met with by those interested in X-ray diagnosis. Children ailing from some unknown cause

will at times be found to have swallowed coins or other foreign bodies which, being lodged in the œsophagus or pharynx, cause them to refuse food. The trouble indeed may exist for three weeks or more without the cause being discovered. A case came under my notice where a small boy who continually complained of pain in the calf of his leg, was found to be suffering from a complete knitting needle embedded in the muscle of this region. The radiologist will meet with many such instances, but perhaps the most common are unsuspected fractures that become evident only after the formation of callus. The bones of the forearm are very likely to suffer in this manner, and children up to the age of five or six often present lumps on these bones which the X-rays show to have been caused by greenstick fractures. It is therefore important when a small child falls on the arm or complains of pain in that situation to examine carefully for fracture or bending, and the rays only will give positive help here. There is, however, another and vitally important use for the rays in this connection, a glance at the accompanying illustration will show what this is :—

A lumpy radius, without definite history of injury or apparent pain, showing the expansion and rarification so typical of the X-ray appearance of endosteal sarcoma.

The position and the history might well have suggested greenstick fracture with callus formation ; or a chronic periostitis from whatever cause would have, from an external point of view, quite accounted for the increase in the diameter of the bone. Other conditions would also have to be considered, and save for an exploratory operation the diagnosis could not have been decided. An X-ray examination, however, completely and definitely decides the lesion as no other known method could. This case is an example of the class which illustrate the impropriety and danger of lay opinions and lay diagnosis in medical radiography.

NEW INSTRUMENTS AND APPARATUS.

We have recently had an opportunity of examining the action of the "Wodal" Mercury Jet Interrupter (Sanitas Electrical Co.). In its most recent form the jets are so placed that the "churning" process is limited, and the necessary cleaning of the mercury thus reduced to a minimum. It works smoothly and noiselessly and seems to be an instrument but little likely to get out of order. It claims that the duration of contact is so precisely regulated that the coil can be exactly suited to the vacuum of the tube.

LECTURES TO MEDICAL PRACTITIONERS ON PHYSICS APPLIED TO MEDICINE.

By Sir Oliver Lodge.

SUMMARY OF LECTURE I.

Direct application of physical principles occurs in the use of the stethoscope, of the thermometer,* in diffusion and osmosis, and in the electrical reactions of muscle and nerve. Recently considerable attention has been aroused by the effect of radiation, and it is to ethereal rays of all kinds that these lectures are directed. The chief divisions of the subject are the use of X-rays in surgery, the use of X-rays in medicine, the use of ultra-violet rays, of high-frequency rays, and of radium rays; and in all cases we have to consider both the production of positive good and the avoidance of positive harm, because the same agency which can destroy diseased tissue or kill bacteria may also inflame or destroy healthy tissue.

There are many kinds of rays, and each has many effects, and they can be produced from various sources. It becomes necessary to sort them out and classify them, so as to deal as far as possible with the beneficial rays only in any given case. The following table summarises the various kinds of ray, the various effects which may be produced by each, and the various sources of electricity which are used in medicine; the order of statement having no particular signification :—

Various rays.	Various effects.	Various sources.
Cathode rays	Chemical	Battery continuous
X-rays	Photographic	Coil intermittent
Alpha rays	Electroscopic	Dynamo alternating
Beta rays	Physiological	Leyden jar shocks
Gamma rays	Bactericidal	High frequency
Brush discharge	Therapeutic	Tesla coil
Radiant heat	Inflammatory	Static machine
Light	Anatomical	Arc lamp
Ultra-violet rays	Illuminative	Vacuum tube
N-rays	Fluorescent	Radium, etc.

In connection with the above table, ultra-violet rays have been proved most directly to be bactericidal; the X-rays have the most immediately anatomical use, in localising foreign

* And incidentally it may be noted that if for any purpose a continuous registration record of the temperature of a patient were desired, an electrical recording apparatus could now easily be made forthcoming for the purpose, on the principle of Callendar's thermometers, as made for instance by the Instrument Company, Cambridge.

bodies, in observing fractures, in exhibiting diseased organs, and in making a chart, especially a stereoscopic chart, of the parts of the body in their true relative positions in space, the vessels being injected for the purpose with some salt of mercury or lead, or other heavy material. By electroscopic is meant the discharging effect on an electroscope. Some of the rays have no power in this direction ; for instance, neither radiant heat nor visible light affects an electroscope in the slightest degree ; ultra-violet light does not affect it directly, but indirectly, by its action on solid surfaces, especially on clean metals.

As to the inflammatory or deleterious action of rays, it is very important to examine and classify them separately from this point of view ; ultra-violet rays are known to be deleterious to healthy skin. It is doubtful whether X-rays are truly hurtful themselves. The existence of N-rays is doubtful at present, but it appears likely that we shall hear much more about them in the future. They may turn out to be of the greatest importance.

The brush discharge is generally produced by the high-frequency apparatus or by a static machine. Vacuum tubes can be employed for illuminating body cavities. The radiant heat treatment, as in the Dowsing process, ought to have a different effect from the use of hot air, as in the ordinary Turkish bath.

Alpha, beta, gamma rays are given off by radium ; alpha rays only by polonium.

Cathode rays are the source of X-rays, and are now believed to be identical with the beta rays. They consist of minute particles of negative electricity flying with enormous speed comparable to the speed of light. When they are suddenly stopped by impact on a solid body X-rays arise. Cathode rays are very efficient in discharging an electroscope and in producing many other effects. It is quite likely that they are responsible for some of the inflammatory effects.

As to the sources of electricity, the continuous current battery (or "Galvanisation") will produce electrolytic decomposition ; the induction coil or intermittent current (or "Faradisation") is in some respects half-way between the continuous current and the alternating current. An alternating current may produce electro-chemical decomposition at low frequencies, but at high frequencies it may be inoperative. Many effects may be produced at one frequency which cannot be produced at another ; for instance, slow magnetic waves from the sun can deflect compass needles, but quick waves of the same kind could not. So it is physiologically : slow alternating currents are strongly felt, but high frequency currenty may not be felt at all, even though of much greater intensits.

Leyden jar shocks exert a peculiar stimulating effect on the nerves. High frequency currents can be obtained from the B circuit of a Leyden jar, or by means of a Tesla coil addition.

A static machine gives something more like a continuous current.

By fluorescent effect is meant the production of actual light by impact on a substance, or a solution, of something which in the first instance is not light, such as ultra-violet rays or X-rays or cathode rays.

Cathode rays, since they consist of flying electrified particles, constitute an electric current, and accordingly can be deflected by a magnet—a useful property which enables them to be sorted out from other rays; otherwise they fly in straight lines, throwing a shadow of any object which they are unable to penetrate.

They have, however, considerable penetrating power. Ultra-violet rays and alpha rays have extremely little penetrating power.

Every electric current is now believed to be a procession or torrent of negatively-charged particles, called electrons. In the vacuum tube the electrons are flying at high speed, constituting the cathode rays. These rays also fly off from radium and other spontaneously radio-active substances. They have great energy, and can produce heat where they strike. They can also ionise the air, producing oxides of nitrogen and ozone. This indirect chemical action is probably an important part of their inflammatory activity.

When an electric current flows in a metal, the electrons are being passed from atom to atom, like a fire-bucket from hand to hand. In a liquid the electrons carry the atoms with them, propelling them as a pony might propel a wagon, and thus effecting electro-chemical decomposition by carrying all the atoms of one kind in one direction, and another kind in the opposite, and delivering them up at the terminals.

The discovery of the true nature of cathode rays, and of the existence of electrons or particles of electricity, has changed, or rather, has made much more definite, our ideas of electric conduction and electric action generally; and although not of immediate application to practice, must be borne in mind throughout.

The cathode rays, constituting as it were a visible electric current, may be said to represent the most fundamental electrical phenomenon, in the sense that they are at the base of and originate almost everything else.

The following is a list of the more strongly radio-active elements as at present known :—

	Atomic weight.	Nearest ally.
Uranium	238 ..	Hexad, like Tungsten.
Thorium	232 ...	Tetrad, like Tin.
Radium	225 (258?) ...	Dyad, like Barium.
Polonium	— ...	Like Bismuth.
Actinium	— ...	——

SUMMARY OF LECTURE II.

DETAILS CONCERNING X-RAYS.

Every electrical and magnetic phenomenon is to be explained in terms of electrons and their movements. A stream of electrons has momentum; hence whenever it is suddenly stopped, something must happen.

A stream of electrons in the thick copper wire of an induction coil constitutes the primary current, and whenever it is suddenly stopped by a break in the circuit a strong secondary impulse is induced, which causes the secondary spark, and the primary spark too, unless that is absorbed or checked by some means. The more sudden the stoppage the more violent the effect. If a current could be stopped absolutely dead in a moment, the secondary effect would theoretically be infinite.

X-rays are generated when flying electrons at high speed are suddenly stopped. The less the time taken over the stoppage, the greater is the penetrating power of the rays produced. This is what happens in very high vacuum tubes; those through which it is difficult to force a current. Such a tube is called a hard tube,* and is employed whenever very opaque obstacles have to be penetrated by the rays. But they do not give much contrast, and they barely throw a shadow of the lighter materials in their way; the only rays more penetrating than these are some of those emitted by radium. X-rays are not particles, but ether pulses, or thin solitary shells of disturbance, consisting of one crest or spreading-out ripple and no more. They can be likened to a whip-crack. They are quite distinct from ultra-violet rays, which have no penetrating power at all. No X-rays reach us from the sun, nor are any given off by an arc lamp.

In order to get less penetrating rays and more discriminated shadows, the vacuum in the tube must be lowered. This can be done either by heating the bulb, so as to drive off a trace of condensed gas from the glass, or by heating a platinum wire which protudes through the walls of the tube, which again gives off some occluded hydrogen; or it can be automatically effected by a supplementary small side vacuum tube attached to the main bulb, and arranged in such a way that whenever the sparks find it difficult to pass in the main bulb, they may jump by another spark gap through the side tube as an alternative path, therein generating a trace of gas, which will enter the main bulb, lower its vacuum, make the main path easier, and so automatically throw the side tube out of action until it is again wanted. *(To be continued.)*

* The higher the vacuum, the greater the velocity of the electrons, hence the greater suddenness of the stoppage, and the greater penetrative effect.

Digest of Current American Literature.

THE RÖNTGEN RAYS AS A PALLIATIVE IN THE TREATMENT OF CANCER.

C. L. Leonard in a short article on the above subject formulates the following conclusion as the result of his experience: The results so far obtained are very encouraging. An agent has been found which has a greater influence in retarding the growth of malignant tumours than any heretofore known. Many remarkable and apparent cures have been obtained. A prophylactic post-operative course of treatment has been developed that will undoubtedly increase the number of cures, while as a palliative agent there is nothing which is capable of rendering so great relief or adding so much to the comfort of those suffering from malignant disease.—*American Medicine,* November 28th, 1903.

X-RAY TREATMENT OF CANCER OF THE UTERUS, METHOD AND RESULTS.—Sinclair Tonsey recommends (1) the application of the X-rays directly to the cervix and uterus through the vagina—a Nott or Ferguson speculum will be found useful for this purpose; (2) if there is a fibroid tumour present in the body of the uterus, raying of the abdomen directly over the tumour; (3) application of the high tension discharge by means of vacuum tube electrodes. The author finds the results of such a plan of treatment most excellent. It is recommended only for inoperable cases. He has formed no opinion as yet as to the possibility of the complete disappearance of uterine cancer under X-ray treatment.—*Medical News,* November 14, 1903.

SOME RECENT INVESTIGATIONS UPON THE ACTION AND THERAPEUTICAL VALUE OF CURRENTS OF HIGH POTENTIAL AND HIGH FREQUENCY.—Dr. Curran Pope reported a case of abscess in the left thumb which was opened, and after evacuation of pus a high frequency current was applied for five minutes. Immediate relief from pain followed and no pus was found afterwards. This was but one of many similar experiences, and the writer was convinced that high frequency currents had a germicidal effect on pus and pus-forming bacteria, and that this was in proportion to the presence of the ultra-violet ray.—*New York Med. Journal and Phil. Med. Journal,* November 30, 1903.

[The effect obtained can not be questioned, but the latest and best research shows clearly that the ultra-violet ray does not kill bacteria in the living organism. Still further, the current in question was undoubtedly applied by means of a vacuum tube of glass (as is the universal custom for local application), and the glass effectually prevents the

passage of ultra-violet rays. Moreover, the effect may be duplicated with the current of many turns of wire from a good medical induction coil, fast interruption; also from a high frequency of the sinusoidal current, and likewise from ultra-violet rays. The same effect has been obtained in the writer's experience from all these different sources of electrical energy.—Am. Ed.].

MECHANICAL VIBRATION.

Clinical Notes of a Case of Hyperchloridia Successfully Treated by Mechanical Vibratory Stimulation.—Rochelle details a case of a man, aged 28, with the following history:—Intermittent attacks of indigestion, sub-acute in character, pain a prominent and distressing symptom of several years' duration. These attacks were characterized by a feeling of discomfort half an hour after eating, quickly succeeded by eructations, flatulence, and more or less pain, often very severe, which gradually disappeared after three or four hours. The symptoms were greatly aggravated by fatigue or excitement at or near the time of taking food. Large doses of alkalies taken for four months prior to coming under care. Test breakfast with subsequent examination established diagnosis. Epigastrium very painful on slight pressure, especially over the pylorus, during the process of digestion; bowels constipated. Classic measures, *i.e.* drugs with non-irritating diet faithfully followed for two months, failed to produce any amelioration of the symptoms. On June 12, 1903, all treatment was discontinued, and mechanical vibratory stimulation applied. Application (with deep pressure) was made with the rubber ball over the lower cervical and throughout the dorsal region, especially over the sixth to the tenth right, and the fourth and fifth left, dorsal. The brush was applied lightly over the stomach, but deeply over the hypogastrium. First treatment, given during a paroxysm of pain, was followed by relief. Bowels moved freely without enemas or laxatives, and their use had never to be resumed. Less pain after first meal following treatment. At the end of the third week of treatment (nine applications), there was no recurrence although diet absolutely unrestricted. At the end of the sixth week all symptoms of gastric irritation had disappeared, test dinner indicated a perfectly normal digestion and patient was (symptomatically at least) cured. An inefficiently performed function was aided by the importation to it of more stimulus and tone from its controlling nerve centres. The difference in the results obtained in similar cases treated by the two methods described compels a most unhesitating award of preference to the latter.—*International Medical Magazine*, October, 1903.

THE INVASION OF MEDICAL PRACTICE BY LAYMEN.

To the Editor of MEDICAL ELECTROLOGY AND RADIOLOGY.

DEAR SIR,—The name of our firm is mentioned in the current number of MEDICAL ELECTROLOGY AND RADIOLOGY with implications which, on a full review of the circumstances and the correspondence referred to, seem somewhat misleading.

The following important paragraphs are omitted from the two letters, from which partial extracts are given. In the letter relating to the case of Lupus, we say, "In the event of your sending your patient to us you would, of course, furnish us with full particulars of the case, and we would carefully follow out your instructions." And in the other letter quoted, we say, "We only undertake these cases under the direct advice of the doctor in charge of the case; we undertake no responsibility in the matter, but merely carry out the instructions received."

Our function in the matter was simply to carry out the directions of the medical adviser with the best possible appliances in the hands of a skilled operator of great experience, and we fail to see how we thus place ourselves in "open antagonism to the medical profession," any more than by making up a prescription with the best materials by competent dispensers, or by carrying out any other of their directions.

Surely the suggested inference that the treatment of the rodent ulcer was not successful, because it was carried out by "the Chemists," is scarcely a fair one.

Trusting that you will find space for this note in your next number,—We are, yours truly,

ALLEN & HANBURYS, Ltd.,

Plough Court, 37, Lombard St., E.C.,
February 19th, 1904.

C. Hanbury, *Director.*

[We are glad to print the above letter from Messrs. Allen & Hanburys, Ltd. At the same time we certainly agree with the views expressed by Dr. Lewis Jones in our last issue. It is deplorable that an old-established and respected firm of Pharmaceutical Chemists should so far forget their relationship with the medical profession as to embark upon medical practice. That they operate only in a special branch of therapeutics is no excuse at all. It is ridiculous to defend the position by claiming that the treatment of diseases, many of them of grave character, by electricity is on a par with the dispensing of medicines.

The question at issue is quite simple. Do Messrs. Allen & Hanbury carry on unqualified practice, or do they not? Apparently, by their own showing, they do. From our point of view unqualified practice is wrong, and no hedging about with conditions can make it right.—Editor.]

Reviews and Notices of Books.

L'Année Electrique, Electrothérapique, et Radiographique. By Dr. Foveau de Courmelles (Béranger, Paris).—This volume comes to us, not only as an annual visitor, but as an old friend. Taking up its interesting and instructive story exactly where it left off last year it now tells us all that is new and all that is true of the twelve months that have just passed. It marshals before us in clear and orderly array the facts and figures that constitute the electrical history of 1900. Commencing with new facts and apparatus, it deals with electrical osmose, frequency-meters, cells, accumulators, etc. Passing on to electro-chemistry, it considers the purification of water and other interesting points. The third chapter is devoted to Light, the fourth to Heat. Then comes Electric Traction. Chapters six and seven deal with Telegraphy, wireless and otherwise. Chapter eight discusses Atmospheric Electricity; chapter twelve Electrotherapeutics; chapters thirteen, fourteen, fifteen and sixteen deal with Radiography, Radio-pathology, Radio-therapeutics and Photo-therapeutics. The volume cannot be otherwise than useful, and is, for the most part, fairly practical; but it does not in every instance furnish the reader with definite details of technique. Thus, in discussing the radiography of arteries in the living subject, it is explained that everything depends upon conditions of radiation, and the more or less penetrating character of the tube; further, that by devices of developing, certain tissues can be brought into prominence and others made to disappear. This is surely very vague and unsatisfying for the enterprising radiographer, who thirsts for detailed information with a view to doing it himself; when results are brought to his notice he wants, above all things, to learn exactly how they were arrived at. Indefiniteness of the kind referred to is much to be deprecated. Happily such instances are few and far between in the book before us. Everyone interested in the subjects that come within its purview must recognise in Dr. Foveau de Courmelles' annual volume a painstaking and instructive *résumé* of the world's work in all that appertains to electrical science during the past year. It seems a pity that such good matter should be printed on such bad paper.

THE ELEMENT OF FAITH IN HEALING.—Kulloch, in a consideration of the above subject, concludes that a limited study of the cures which have been produced through faith in a remedy or in the healer's skill, should convince us that this valuable adjunct should not be lost to a profession whose aims are usually far above self-interest.—*N. Y. Medical Journal and Phil. Medical Journal*, December 12th, 1903.

PROCEEDINGS OF THE AMERICAN ELECTROTHERAPEUTIC ASSOCIATION.

(Continued from p. 26.)

Dr. FRANCIS G. DU BOSE, of Selma, Alabama, sent a paper, entitled "Currents of High Frequency, Apparatus and Therapeutic Uses," which was read by Dr. Massey.

The well known high frequency apparatus, giving several million oscillations per second, was first described. The author then proceeded to point out that, on account of the high frequency, the sensory nerves were unable to respond, so that a current of 400 m.a. could be passed without causing pain. High frequency currents were of general therapeutic utility, being of special value in obstinate cases of chronic rheumatism and of joint enlargement. In conditions of malnutrition they acted more rapidly than drugs. Post-operative pelvic pain and various congestive conditions of the pelvis were very amenable to treatment by these currents. In minor surgery it was useful in the production of local anæsthesia. A year's experience had led the author to believe that it was one of the most useful of all electrotherapeutic methods.

Dr. ROCKWELL took exception to the statement made by the author regarding the ampèrage or magnitude of these currents. In his opinion the magnitude was so reduced in the step-up process that he believed it to be not more than three or five milliampères. He had had some experience with high frequency, or the d'Arsonval current as it was otherwise called, and had long since come to the conclusion that no effect upon nutrition could be traced to the "hypostatic" current, so that its use was almost entirely restricted to the treatment of superficial diseases of the skin.

Dr. BISHOP said that he had seen a lamp of 16 candle-power rendered fully incandescent by connection with a d'Arsonval coil. He had used high frequency currents with good effect in rheumatoid arthritis, enlarged joints, and also in various forms of neuritis. He believed that they would be more generally used than any other current in electrotherapeutics.

Dr. GEORGE S. GOODELL, of Salem, Mass., in a paper on "Electricity in the Treatment of Chronic Deafness," which was based upon replies to circular letters and upon a study of the literature of the subject rather than on personal experience, stated that the cases treated were examples of catarrhal (non-suppurative) otitis media. Tinnitus had been relieved by mild interrupted currents, but no cures of the condition were reported. The polarity was of no moment.

Better results were obtained with the continuous current, using water as the aural contact, connected with the positive terminal of the source of the E.M.F. Electrolysis of the Eustachian tube had been employed somewhat extensively of late, and was strenuously advocated by Dr. Arthur B. Duel and the late Dr. Robert Newman. Many aurists, however, were of the opinion that it gave no better results than simple dilatation of the Eustachian tube.

Dr. CHARLES W. DANIELS, of Savannah, Georgia, contributed a paper, "Clinical Report of the Use of the X-ray in Lesions of the Spinal Cord," which was read by Dr. Snow.

The author disclaimed any intention that this method of treatment would effect a *cure* in any case of tabes. At the same time he insisted on its probable value in controlling degenerative lesions. Two cases of tabes were reported greatly improved, although the associated pains could not thereby be entirely removed. Two cases of arthritis deformans, that were still under treatment, appeared to be improving.

"The Employment of Static Electricity in the Treatment of Nervous Diseases" was considered by Dr. W. B. SNOW, of New York. The treatment of diseases of the nervous system depended largely upon the relief of congestion and the improvement of nutrition. For the latter purpose, he believed an electrical current should have high potential, great penetrability, but small current-flow. The "wave" current, in his opinion, best met the indications. By such an application there were produced contraction of the muscular tissue, electrolysis and polarization. There were very few nervous diseases but were associated with inflammatory conditions. In acute neuritis contact was made over the affected region, and as long a spark gap as was possible was used, gradually increasing it, for 20 minutes; then sparks were applied to the course of the affected nerve. In chronic neuritis the disruptive discharge was the main reliance, and sparks were to be applied to the course of the nerve, or nerves, involved. Excellent results were obtained in all stages of anterior poliomyelitis, contact being made, by means of a soft metal electrode, over the spinal column, and the "wave" current with an extremely long spark gap used. Neurasthenic conditions yielded to the same method.

In the discussion that followed, Dr. R. J. NUNN said that radium exhibited the highest known vibration of the ether, and that it was just such vibrations that were necessary for treatment. The higher the vibration, the greater was the curative property. All electrical currents presented vibrations, the lower serving as diluents of the higher; the tissues being burnt by the lower and penetrated by the higher vibrations. The burns caused by the use of a continuous

current, the X-rays and radium were then instanced. The two papers last read plainly proved that the higher vibrations were the curative element, and that the better we learnt how to use this agent, and to dilute it to suit particular cases, the better would be the result.

Dr. T. A. PEASE believed that the chief curative action of electricity depended upon vibration. With his static machine (six revolving plates) and a transformer made out of watch springs, enclosed in a glass tube, he was able to double the usual output and make vacuum tubes glow, in any part of his office, without contact with his patient.

Dr. CHARLES O. FILES, of Portland, Me., said that he had for many years believed that the removal of congestion was accountable for the relief obtained through the agency of electricity. By the stimulus imparted, the flow of blood through the capillaries was quickened and stasis diminished, so that insomnia could, for example, be relieved. Frequent repetitions were necessary to secure a permanent good result. Every form of congestion was amenable. This theory certainly gave him a good working hypothesis, and was in accord with observed facts.

Dr. J. R. STUART, of Minneapolis, also believed that high frequency currents were of great service in relieving congestions.

EQUESTRIAN THERAPEUTICS.

Horseback-riding, says E. W. Lee, is not only a necessity, but a convenience, comfort, pleasure, and above all, the most health-giving exercise one can indulge in. It is not a new thing. It is not a fad. Horse and man have been associated since time immemorial. In the words of a famous surgeon, the late Frank Hamilton, "The best medicine for the inside of a man is the outside of a horse." It is of special value in so-called torpid liver, chronic functional disturbances of various kinds, and pulmonary and nervous troubles. Especially is this true of that form of indigestion known as nervous dyspepsia. The great good derived from horseback exercise is due to the beneficial effect it has upon the circulation. It is the remedy *par excellence* for the business man at the close of the day, fatigued mentally and physically with aching head, due to cerebral congestion from worrying over complicated problems. There is nothing so develops the beauty of women as horseback-riding, and modern society women drive too much and ride too little. There is no tonic equal to the clear bright sunshine, the pure refreshing air and the best way to obtain that is on the back of the horse.—*N. Y. Medical Journal and Phil. Medical Journal*, December 12th, 1903.

PART II.

PROCEEDINGS OF THE BRITISH ELECTROTHERAPEUTIC SOCIETY.

Edited by CHISHOLM WILLIAMS, F.R.C.S., Ed.

FEBRUARY 26th, 1904.

The Nineteenth Ordinary Meeting was held at 11, Chandos Street, Cavendish Square, W. The President, Dr. LEWIS JONES, occupied the Chair.

Present:—21 members and four visitors.

Minutes of the last meeting were read and duly confirmed.

The following gentlemen were unanimously elected ordinary members: W. Johnson Smythe, M.D., Durley Gardens, Bournemouth; G. Allpress Simmons, M.D., 216, Ashley Gardens, S.W.; A. Primrose Wells, L.R.C.P., 6, High Beach, Felixstowe.

Dr. A. D. REID exhibited the following interesting case treated by X-rays and radium:—

G. D., aged 46, first noticed a lump in the right breast early in 1895. In April, 1896, she was admitted to King's College Hospital, where the tumour, which was found to be a scirrhus, was removed by Mr. Watson Cheyne.

In July, 1898, she was readmitted with a similar tumour in the left breast of six months' duration. This was removed by the same operator. In June, 1899, a large mass of glands were noticed on the right side above the clavicle.

These were excised and found to extend deeply, being adherent to the carotid sheath to such an extent that part of the internal jugular vein had to be removed. In July, 1900, a mass about the size of a walnut was removed from the triangles of the neck, and at this operation it was noticed that the emaciation of the patient and the removal of the fascial structures of the neck had rendered the brachial plexus practically subcutaneous.

In January, 1902, some small nodules were seen in the situation of the scar from the preceding operation, for which operation was not advised. In July, 1902, the skin over this area broke down and remained ulcerated. No active treatment was adopted, owing to the proximity of the brachial plexus, until February, 1903, when she came under my notice in the X-ray department.

At this time there was an irregular unhealthy looking ulcer, about $1\frac{1}{2}$ in. × 1 in. situated about the anterior border

of the trapezius just above its clavicular attachment. The edges were indurated and somewhat undermined, the base was covered with pale, weak granulations.

From February 1st to March 13th sittings of seven minutes each were given, after which the treatment was stopped. On March 13th the indurated edges had disappeared and the floor of the ulcer was composed of a flat, clean, healthily granulating surface, and by April 30th the wound had completely healed.

The patient has been kept under observation monthly, and on June 12th, 1904, it was found that at the upper and lower ends of the scar there were suspicious nodules, and there was a small breaking down nodule over the sternum at the level of the third interspace. A small gland was noted at the same time over the hyoidbone.

Treatment with radium was then commenced. The radium enclosed in a metal capsule with a mica window was enveloped in a piece of gutta-percha tissue twisted round, so as to form a stalk opposite to the mica window. The stalk was passed through a slit in a piece of strapping, which was stuck over the spot.

After 12 sittings of ¼ hour each, the nodules were found to have disappeared. Some more nodules have appeared, which are now in process of being treated.

As a result in all probability of the cicatrisation of the ulcer in the neck, the brachial plexus has become affected, with the result that there has been gradual wasting of the muscles of the thenar eminence.

In the unavoidable absence of Dr. David Lawson,

The HONORARY SECRETARY read his paper, which was amply illustrated by many most excellent lantern slides.

A FURTHER CONTRIBUTION TO THE USES OE RÖNTGEN RAYS IN THE STUDY OF LUNG DISEASES.

BY DAVID LAWSON, M.D.

It is convenient to preface the subject matter of this thesis by an allusion to the vexed question of the POSITION in which the patient should be placed when undergoing chest skiagraphy. In the following cases, with the exception of those instances in which it was desired to obtain a skiagram of fluid, whether extra pulmonary as in the case of pleuritic effusions, or intra pulmonary as is sometimes present in lung cavities, the patient lay on his back with his hands placed over his head, and the plate interposed between him and a couch. The anticathode of the vacuum tube was placed over the chest

and focussed over the mid-sternal line, opposite the fourth rib, 24 inches distant from the plate. The patient was not asked to hold his breath but, on the contrary, was permitted to breath freely during the term of the exposure. Where fluid was suspected to be present the procedure adopted was somewhat different, for there the patient sat in the erect posture with the plate placed in close apposition to his back by means of a specially adapted chair, which at once retained the plate in the desired position and furnished the patient with a comfortable support. The fact that this position is considered by some to possess serious disadvantages when compared with the "face to plate" position, may be held to warrant a statement of the grounds upon which this method was adopted in preference to the latter.

Briefly stated they are as follows:

1st. From the circumstance that the patient occupies a natural position and is therefore more comfortable than when lying upon his face, two advantages accrue. In the first place there is no embarrassment in the breathing added to that already due to the diseased condition, and, therefore, there is no increase in the rapidity of the movements of the chest walls. Further, there is no increased tendency to produce cough, with its attendant disturbance of the area being photographed; thus definition and clearness are more likely to be secured by the "back to plate" position than where one of the other positions is adopted.

2nd. There is greater certainty in obtaining a skiagram of an early phthisical lesion by this method than by the other. This arises from the pathological fact, demonstrated by Kingston Fowler that the vast majority of apical lesions start in the posterior third. As there seems little doubt that proximity to the plate is an important element in the production of the shadow caused by lung lesions, the advantage of the "back to plate" position from this point of view is at once obvious. This difference in the appearances shown in the early cases by the two methods is by no means a theoretical one; for it has been more than once observed that whilst screening a chest from the front it showed little or no deviation from normal, a succeeding examination by the "back to screen" method at once confirmed the evidence of the physical signs as to the existence of a distinct lesion.

3rd. But there is another, and I venture to think a stronger reason than either of those already referred to for adopting the "back to plate" method in routine lung work. It is exemplified by the slide which is now before you. (I refer to the confusing and misleading appearance caused by the presence of the intense shadow corresponding to both the anterior and posterior portions of the ribs in "face to plate" skiagrams.) The shadow of the anterior ribs is either very faint or indeed

may be altogether absent in those cases in which the skiagram is taken by the method now advocated.

It has doubtless occurred to some to enquire into the reasons which account for the absence of all trace of the anterior portions of the ribs in skiagrams which have been taken in the "back to plate" position. Can this feature, it has been asked, be explained by the fact that when the patient is lying on his back the anterior half of the rib moves freely, whilst the posterior portion remains almost stationary, and that the difference in the movements in these parts accounts for the disparity which exists between a shadow corresponding to the back portion and the front portion of the rib respectively? That the movements referred to do not satisfactorily account for the phenomenon alluded to seems to be suggested by the following evidence:—In the first place where a skiagram has been taken in the "back to plate" position with the minimum exposure—15 seconds—as in the case of the one which I now show you, and for which I am indebted to the courtesy of my friend Dr. A. H. Lister, of Aberdeen, the front portion of the ribs can only with difficulty be traced, if at all. In this case, the time occupied was so short that only the minimum movement of the ribs could have been possible, whilst the shadow caused by the back portion is well-marked there is no trace of the front ribs upon the plate. In the second place, where the skiagram had been taken whilst the subject held his breath throughout as in this case, and the movements were therefore altogether suspended, there is no difference in the relative appearance of the ribs. Thus, then, there seems no room for doubt that the increased movements of the front of the ribs do not account for the loss of the shadow corresponding to it when the patient is skiagraphed in the "back to plate" position. If, then, the difference in the shadows cannot be satisfactorily accounted for by the unequal movements of the different parts of the ribs, to what factor, it may be asked, does it owe its existence? To that question I venture to furnish the reply that the difference in the composition of the rib itself at the anterior and posterior end respectively, is the principal cause of the disparity of the shadows referred to. And in support of that opinion I direct your attention to the following two slides which graphically represent the evidence upon which this view has been founded. In the left hand part of this slide you see a rib skiagraphed with its posterior part next the plate, in it you will see that the back portion shows much more densely than the anterior. On the right hand of the slide the same rib is photographed with its anterior part next the plate, the rib itself being as far as possible made to occupy the position it would in the body. The posterior part, though situated some six inches from the plate, shows as densely, if

not more densely, than the anterior part. The next slide represents the anterior and posterior portions sawn from the same rib. The pieces were first photographed lying on the plate, and then at a distance of eight inches from it. In both cases the greater density of the posterior half of the rib will be noticed.

The Diaphragm.

In approaching a discussion of the evidence afforded by X-rays as to the behaviour of the diaphragm, one is at the outset confronted with the difficulty of demonstrating the different phenomena which one has observed. This arises from the fact that the chief value to be derived from a study of the appearances presented by the diaphragm lie in the direction of observing on the screen those variations in the movements which take place during the different phases of the respiratory cycle. It is convenient to begin by alluding to the *piston* movement, which takes place in the diaphragm during respiration, as first referred to in this country by Walsham. The slide now before you shows the level of the diaphragm in a healthy man taken at full expiration. Your attention is directed to the presence of a small cross placed near the level of the diaphragm, and the relation which it bears to the latter. The cross and the diaphragm are practically at the same level. The next slide shows the position of the diaphragm during forced inspiration in the same subject. In both skiagrams the cross is located at the same level. As you will readily perceive, the difference between the cross and the diaphragm in slide No. 2, is very much greater than in slide No. 1. This is accounted for by the fact that the diaphragm has moved bodily downwards during inspiration. The next slide shows fairly well, especially on the right side the range of movement of the diaphragm in ordinary inspiration and expiration respectively. We may take these, then, as fair examples of how the diaphragm behaves in the vast majority of cases. But to the general rule there are some important exceptions, and it is to these that I now propose to draw your attention.

1st. In certain subjects where thoracic breathing markedly predominates, the abdominal viscera, instead of plunging upwards and downwards along with the diaphragm, remain during inspiration and expiration in exactly the same position. The sides of the diaphragm in these cases, instead of rising and falling, appear to contract in the direction of the central tendon, that is, the movement instead of being vertical is a horizontal one. In one case under treatment, which may be taken as an example, the upward vertical movement of the central part of the tendon amounted to about a ¼ of an inch, whilst the movements at the sides were practically nil.

2nd. The jerky movements of the diaphragm. In a well-marked case of spasmodic asthma complicated, however, by tuberculosis, which recently came under my notice, the phenomena observed were as follows: there was fairly free vertical movement on both sides to the extent of about 1½ inches. The downward movement of the diaphragm, corresponding to inspiration, was quite smooth and steady, and in this respect offered a striking contrast to the upward movement of expiration; for there, instead of the movement being smooth and continuous, it was markedly prolonged, and it consisted on an average of not less than seven well-defined jerks. Such were the observations made when the patient was being attacked at least once in every 24 hours. As he improved these attacks became less frequent, and an observation made after he had enjoyed immunity from asthma for a period of over a week showed the movements of inspiration to be unaltered, but the expiratory jerky movements to have largely disappeared; the prolongation of the time, however, remained much the same as before.

3rd. Fixed diaphragm. In one case where there was no fluid present the diaphragm was fixed. It was absolutely immovable and presented a somewhat peculiar outline. The photograph shown was taken with the anticathode as nearly as possible over the diaphragm. The case is of interest because of two features which it shows: (1st) As the lung lesion improved the immobility gradually disappeared, and the amplitude of range as observed by screening increased upon both sides to about an inch in extent; (2nd) When the patient was examined by the lateral oblique method of Mignon, after he had acquired a fair range of diaphragmatic movement, the posterior mediastinum was observed to be only very slightly, if indeed at all enlarged during full inspiration, the heart being hardly at all thrown forward during the act. This fact is particularly interesting in view of Keith's researches on the limiting action of the crura of the diaphragm.

Associated Movements.

4th. These are movements which I have not before seen alluded to in the literature of the subject, and I have suggested this name for them, because in each case in which they have been observed they have been associated with distinct lung lesions usually localised sometimes with infiltration, sometimes with cavity formation. Thus, in certain cases where consolidation was apparently most marked towards the posterior aspect of the lung, the amplitude of the range of the diaphragm towards the back, as measured by the screen shadows, was considerably less in extent than the amplitude

at the front; furthermore, the relative level of the diaphragm on the affected side as compared with that on the unaffected side, as seen from the back, was higher than observed at the front. Thus, in one case where the shadow of the apices of the two lungs was most marked at the back, the right being more affected than the left, during deep breathing the range of movement at the back was exactly half as seen at the front. Again, in another case where the right lesion was most marked at the back, and the left most marked at the front, the left side of the diaphragm, as seen from the front, was distinctly higher than the right; but from the back the normal relation was preserved —that is, the right was slightly higher than the left. In two cases of cavity formation, one, where the cavity was, both by physical signs and X-rays, diagnosed as being in the anterior part of the left lung, the diaphragm on that side was again distinctly drawn up anteriorly, and in still another case, where the cavity was undoubtedly towards the posterior part of the same lung, the posterior part of the left diaphragm was comparatively higher than at the front. This observation has a very special interest when we remember that there are those who hold the view that X-rays can reveal nothing to us about the diaphragm which cannot be ascertained by a careful use of Litten's sign. Since the evidence furnished by Litten's sign is largely dominated by the level to which the diaphragm rises near the anterior wall, a localised elevation at the back, such as in those lesions referred to, could not be demonstrated by those means. In such cases as those, at all events, X-rays are a method of accurate diagnosis and hold a decided advantage over this method of physical examination.

5th. Another point, which may be of interest, was noticed in the skiagram which is now thrown on the screen. As will be seen, practically the whole of the left lung was involved, and the right lung, but to a considerably less extent, was also affected. In this instance, the movement on the left side was about double that upon the right. To be accurate, at the front the left diaphragm moved 1⅝ inches, right in front ½ inch, the left at back 1⅛ inches, right at back ⅞ inch. In this instance the movements of the diaphragm upon the left side were less impaired than they were upon the right side.

Why should this have been so?

It may have been due to the fact that the disease upon the left side was of longer duration and less active in character than in the right.

Probability is lent to this explanation of diminished activity by the observation made in the cases of patients examined when active disease is present in the lung and again at a later date, when the patient has undergone a course of training in the form of hill-climbing, and arrest has been

secured. In such cases it has frequently been observed that the diaphragm upon the affected side during the stage of active disease moved less freely than upon the sound side. As convalescence proceeded and compensatory breathing became established the diaphragm gradually altered the character of its movements, until at length the side which at one time exhibited impaired movements came to show movement which equalled or even surpassed by as much as half an inch the movement of the other side. Here the limitation of the movements of the diaphragm corresponded to the period of activity, lasting whilst active disease was present and disappearing when the active disease disappeared.

FLUID.

In presenting to you a picture showing the following simple experiment, I trust I shall not be held to be dealing with a matter of so elementary a nature as to be unworthy of your attention. Two similar rubber bags A and B were taken, and into each was poured an equal quantity of serous fluid, which had shortly before been obtained by aspiration from a case of fluid pleurisy. From one of the bags air was as far as possible extracted, but in the other it was allowed to remain. The bags were then examined by screening, and afterwards the skiagram now shown was taken. I ask your careful attention to the different appearance presented by these bags respectively. You will at once note the fact that whilst that portion of the bag which contained *fluid only*, is represented by a dark shadow, whose upper border gradually merges off into a clear area above, the appearance is different in the case of B, which contains not only *fluid, but air in addition;* for there you will observe, that unlike the appearance obtaining in the case of A, a clear line of demarcation exists between the shaded area and the clear portion above. And again, whilst the upper level of the fluid in A takes a somewhat irregularly curved form, it is not so in B, for there the line of demarcation is absolutely horizontal. Moreover, the edges of the shadow in A are seen to be drawn up to a considerable distance above the other portion of the curve. It is not so in the bag B, whose clean cut horizontal line extends right across to the outer edges. In short, in the first bag where the upper portion is not distended by air, the force of capillarity has full play, and tends to draw the fluid up in the form of a wedge-shaped column, which eventually tapers off and disappears. This accounts alike for the curve at the edges, and also for the gradual diminution in the intensity of the shadow from below upwards. In the second bag which, in addition to fluid, contains air at atmospheric

pressure, owing to the sides of the bag being kept apart by the air, the action of capillarity is reduced to a minimum, and in consequence the fluid is allowed to remain in accordance with the laws of gravity in a horizontal position.

The analogy existing between a rubber bag containing fluid and a close serous sac such as the pleura with contained effusion, was considered sufficiently close to warrant the inference that the phenomena observed in the case of the bag A were not unlike those which one might reasonably expect to find in the case of fluid pleurisy, and that those present in the case of bag B might closely resemble the appearance present in the case of hydro or pyo-pneumothorax. As skiagrams were obtained both from cases of fluid pleurisy and pyo-pneumothorax I am in the position of being able to submit a series of slides in illustration of this part of our subject. This skiagram is one of a case of right-sided pleurisy with effusion, from which 52 ozs. of fluid were withdrawn. As in the case of A where air was absent the shadow merges gradually upwards into the light area above, and further, appears somewhat higher at the side than in the centre. The upper surface, whilst it shades off upwards does so very gradually, and, moreover, as in the case of bag A, there is complete absence of a clear-cut line of demarcation between the shaded and the clear space corresponding to the upper level of the fluid.

The next series of illustrations are taken from a case of pyo-pneumothorax (Fig. III. & III*b*). The case, being one affording special points of interest, I take the liberty of dealing with it somewhat more fully than has been done in the case of fluid pleurisy. A young naval cadet seventeen years of age was sent to hospital in August, 1903. The chest was aspirated on the 5th of August and the following day it was opened and a portion of the seventh rib having been removed a drainage tube was inserted. The amount of pus removed was four and a half pints. It was odourless, but contained many flocculi. Two weeks afterwards the tube was removed and the wound allowed to close. This it did rapidly, and soon afterwards the patient was sent to Deeside to convalesce. He came under my observation on September 10th, that is five weeks after the operation and two weeks after the wound had closed up. I at once examined him by screening. The appearance then observed is represented in the next two photographs, with one important exception : the screen revealed the presence, not demonstrated by a skiagram, of a quick rippling movement at the surface of the shadow which moved rhythmical with the heart-beat. That the shadow upon the right side was due to fluid which had accumulated hardly permitted a doubt. And the fact that the upper border of the shadow was clearly defined, horizontal, and capped by an exceptionally clear zone, seemed to demonstrate the presence of air

above; indeed, that the case was one of pyo-pneumothorax seemed almost certain.

The round mark which is to be noticed upon the right side represents a coin which was made to adhere to the scar of the old wound by means of plaster, and indicates the site of operation. It is therefore evident that if the wound had not been permitted to close, the accumulation, such as is here represented, could not possibly have taken place, for it would undoubtedly have been relieved by the effective drainage which the wound would have afforded.

For the idea underlying the skiagram (Fig. I,) I may say I am indebted to Dr. Walsham, who published a similar case about a year ago. The patient was next tilted over at an angle of 30 degrees and a skiagram obtained as represented in this slide. If further evidence were required as to the presence of fluid it was to be found here, where the fluid following the laws of gravity cast a shadow which remained horizontal under the changed conditions. Had the shadow been due to solid lung its upper edge must have remained at right angles to the spine.

Next morning free drainage was re-established at the site of the old wound by operation, and the condition relieved. The case ran a favourable course, the tube was removed on the 24th September, and the patient resumed his duties on board ship in January, apparently quite well. The next skiagram (Fig. II,) shows the appearance four months after operation, and immediately before work was resumed.

Changes in Lesions.

We pass now to deal with three skiagrams of which, if one is to be guided by the paucity of reference to it in medical literature, is a relatively rare lesion. I refer to infiltration of the upper portion of the lower lobe of one lung where the upper lobe is either not involved at all, or if it is so it is affected only to a very minute extent. Kingston Fowler's reference to the subject may be quoted: "It is very rare except in cases of 'crossed lesions' to meet with a case either during life, or on the post-mortem table in which the lower lobe is affected whilst the apex of the lung is free from disease."

The first of these is that of a lad of seventeen years of age, and the second that of a well know athlete 23 years old, and the third that of a lady of about the same age. In this connection I take advantage of the opportunity which the circumstance affords of stating the opinion I have formed that the prognosis in such cases is serious, out of all proportion to the amount of the lung structure involved. In the second case

to which I have referred the patient passed under treatment within six weeks of taking part in an International Rugby Football Match. He was a man who had lived a model life and possessed of a physique and proportions such as one considers an ideal type of physical development. He steadily improved during the first four months of treatment, after which the general and local condition became stationary and all subsequent attempts to put the patient upon exercise ended in a rise of temperature immediately appearing. After having spent a period of 12 months undergoing treatment I advised a change of climate, and the patient went to Davos. Here he was at once assured that the prognosis was excellent. Still the experience there was no better than it was at home, and the latest information that reached me was to the effect that the disease was undoubtedly advancing and that the larynx had become involved. My experience in other three cases of this lesion observed during the past three years has been much the same, consequently pending the accumulation of further evidence I am disposed in such cases where X-rays reveals this lesion to be present to regard the ultimate prognosis with some concern. It would be well if others engaged in lung work would record their experience in cases of this type so the correctness or inaccuracy of these conclusions may be confirmed.

It is proposed next to exemplify

Retrogressive Lesions.

By retrogressive lesions are meant those cases in which the disease is receding and the recovery of the patient taking place. This slide represents a case of pleurisy (dry) with infiltration of the underlying right lung. The case ran a favourable course. A period of eighteen months having elapsed after this skiagram was taken, the patient returned to see me, and I embraced the opportunity of again skiagraphing his chest. The slide which is now before you was made from this skiagram which was taken upon the second occasion. In comparing the two pictures one is struck by the fact that the shadow corresponding to the lesion shown in the first slide has largely disappeared and has given place to a brightly clear appearance. The patient has obviously to a large extent regained the use of the affected side, and the air is once more entering the right lung freely.

The next slide taken from a similar case represents the change which has taken place in an interval of eleven months. The original photograph of the right lung occupies the left side of the slide, and the later the right.

Passing now to

Progressive Lesions.

Lesions, in which the disease is advancing, as in the case of retrogressive lesions, I propose to limit my illustrations to two cases. The first is taken from a case of extensive infiltration of the left lung with early cavity formation, and to a less extent of infiltration of the right lung. The disease progressed uninterruptedly, so that at the end of five and a half months a considerably greater amount of excavation, as represented in skiagram 2, had taken place. Here it may be stated that in the area, which but five and a half months before was occupied by consolidation, and a comparatively small cavity, there is evidence of a disintegrating process having been at work, resulting in a formation of three large distinct cavities.

The next case is even more interesting. The first illustration (Fig. III) shows the appearance presented by a very extensive infiltration (accompanied by some collapse consequent upon basal pleurisy) of the left lung. Four months afterwards it was found that infiltration of the right upper apex had developed, and the presence of a lighter area at the left apex indicated that excavation at that point had begun. During the three succeeding months rapid changes took place. Upon the right side, as is seen in the second skiagram (Fig. IV), infiltration had advanced until barred by the presence of the septum separating the upper from the middle lobe. The horizontal line at the base of the shadow I take to represent the site of the upper septum. Whilst this progressive infiltration was at work excavation had already set in, not only at the point first infiltrated at the left side but also at the upper portion of the right lung. Thus you will clearly see the presence of the three cavities which have in this way formed. I may say that those facts were arrived at independently by a study of the physical signs, and the evidence furnished by the skiagram corroborated with remarkable detail the view as to the condition which had been formed, previous to the patient entering the X-ray room.

Dr. G. B. Batten thanked Dr. David Lawson for his valuable paper and was very sorry he was too ill to be present, he would have been most welcome. He remarked that Dr. Lawson's remarks regarding the bad prognosis of tubercle of bases of lungs were very valuable, and supported this view by relating points of interest in such a case during life and at the post-mortem.

Dr. H. Lewis Jones congratulated the author on the well reasoned and well written paper. He feared there were

not a large number of people who were able to discuss such a highly specialised branch of X-ray work. He was very interested with the effect of air in the pleura in determining the sharpness of level of the fluid. He would like to hear of the relative opacities of pus and of serum.

He would like to ask as to early diagnosis and to instantaneous exposures; and related a case which he had seen where both lungs contained what seemed to be numerous miliary tubercles. The patient had no chest symptoms, but developed some obscure abdominal symptoms which in the light of the radiographs of her chest were suspected to be tubercular, an opinion which seemed to be confirmed by the course they were now running.

Dr. STANLEY GREEN said that he had listened to Dr. Lawson's paper with great interest as he had himself been working on the subject for some years, and he regretted the absence of the author as there were one or two points he would have liked to discuss with him. He could certainly endorse Mr. Crombies' statement that pus cast a much more dense shadow than a serous effusion, in the former case generally obscuring any shadow of the ribs, and this was well marked in a case of pyo-pneumothorax, which also showed the horizontal line of the fluid which Dr. Lawson showed was the case when air was present in the bag; and also in a case which he was asked to examine last week, which was thought to be phthisis, but which on screen examination proved to be an empyema, and this was demonstrated by aspiration. There was one very important point he thought Dr. Lawson might lay stress upon, and that was that in all cases the history symptoms and physical signs should be carefully compared with the X-ray examination; if this is not done, we shall not only be treading on the toes of the physicians and encounter a great deal of opposition, but we shall also be liable to misinterpret the shadows cast upon the plate and screen, and this was especially the case where consolidation having taken place without cavitation and the physical signs had cleared up under treatment the shadows remained and were of the same density. Another very important point should be laid on the early diagnosis of phthisis, as he believed that in some cases this could be done by means of the X-rays before physical signs were apparent, and he quoted a case where he had discovered deposit in the right apex one month before there were any physical signs; at the end of this period it was apparent in both lungs.

Dr. G. B. BATTEN also supported the vote of thanks to the author of the paper.

The meeting then concluded.

NOTICE.

Members are reminded that the subscription (one guinea) for 1904 became due on January 1st, and should be sent to the Honorary Secretary, 20, Bedford Square, W.C.

SPECIAL NOTICE.

Any member willing to show cases, etc., or read a paper are earnestly requested to inform the Honorary Secretaries as soon as possible. The following dates have been fixed for the meetings: March 25th, April 22nd, May 27th, June 24th, July 22nd, October 28th, November 25th and December 16th.

HYPNOTIC THERAPEUTICS.

Wallace, in a paper entitled "*Some* Experiments and Conclusions in Hypnotic Therapeutics," reports a number of cases in which he has used hypnotism with success. He believes the results are not so much due to suggestion as to concentration, suggestion merely helping to hold the mind. Hypnotism seems to have a definite psycological action. By concentration strain is put upon the vasomotor nerves, resulting in a paresis of the whole vasomotor system, with diminished blood pressure. Blood is very easily determined to any portion of the body, because, with one exception, the vessels are wide open. In hypnotic sleep there is a cerebral congestion, but in normal sleep the brain is anæmic. If in the condition induced by hypnotism, the patient's attention be directed to a certain portion of the body, the blood rushes to the centre, presiding over it. There is in consequence an increased nutrition of the centre, and of the painful area connected with it, with corresponding tissue change.—*Medical News*, December 19th, 1903.

HOT AIR.

Tinnitus Aurium. Can it be relieved?

This question is answered in the affirmative by Dr. A. Schloss, who uses a Hopkin's electric heater. The air is permitted to reach a temperature of from 200 to 300 degrees Fahr., according to the case, and is used at a pressure of from five to six pounds for as long a time as the patient can tolerate it, not exceeding five minutes, however. The diameter of the opening of the ear piece is $\frac{3}{16}$-in., and the stream of air is directed as nearly as possible against the tympanum. Three treatments a week were given for eight weeks. No failures.—*Journal American Medical Association*, September 12th, 1903.

MEDICAL

Electrology and Radiology.

No. 4. APRIL, 1903. VOL. V.

EDITORIAL.

There can be no doubt that the property possessed by certain substances of appearing self-luminous, when exposed to the direct action of light rays, was a phenomenon known to the ancients. The discovery in tombs of "tear bottles," which are fluorescent to a remarkable degree, and the occasional references to this peculiarity noticed in the works of Pliny, Albertus Magnus, and other writers of the Western School of Civilisation would be sufficient to substantiate such a claim even if more direct evidence were wanting. To the Oriental School of Philosophy the honour belongs of having initiated the first philosophic, if not truly scientific, research into this subject. So accurate are many of their observations that, stripped of the superfluous and taudry tinsel with which Eastern mysticism and religious superstition loves to cloak its discoveries, the facts recorded in the fourth book of the Talbath Rayaol could well pass as an exposition of the present position of modern knowledge of the subject. A liberal acquaintance with phenomena dependent on reflection, refraction, diffusion and absorption of luminous radiations, coupled with that of fluorescence, allowed them to imbue the uneducated mind of the public with a superstitious reverence for the occult powers of the teacher and the necessity for a very strict observance of the ritual enjoined for the prevention and cure of diseases, which modern science has proved to be injuriously affected by ultra-violet radiations. In descending to more modern times we remark that Vincenzo-Casirolo in 1602 records some observations of a similar phenomenon noticed in connection with Bologna phosphorus—an impure sulphide of barium obtained by calcining sulphate of baryta with gum and other resinous exudates. The discovery of Canton's phosphorus (calcium sulphide) and Homberge phosphorus (chloride of calcium) stimulated further research in this direction, and much speculation as to its causes was indulged in. Muschenbröeck's discovery of a similar property in petrol and Häuy in fluor-spar were the next to attract attention; but it was not till the year 1852, when Stokes published his experimental researches on "Changes of Refrangibility of Light" that the true cause of the phenomenon, previously termed "epipolic dispersion" was arrived at. He also succeeded in demonstrating this property in many substances not

popularly recognised as fluorescent, *i.e.*, wood, horn, bone, leather, skin, the claws of animals, and the foliage of certain plants. Fluorescence, as now understood, may be defined as the property whereby light rays of a refrangibility higher than those of the visible spectrum are rendered perceptible to the eye, by a transformation produced by the substance under experiment in the wave-length of the incident rays. Herschell has proved that fluorescence, like phosphorescence, is due to the direct action upon the substance of the more refrangible rays, blue, violet and ultra-violet; while he, by spectroscopic analysis of rays emitted by fluorescent substances, has shown that in it the blue and all radiations above it are suppressed, *so that the light so filtered ceases to excite fluorescence in any other substances exhibiting the same property.* Among the better known fluorescent substances—quinine bisulphate, esculin, petrol, tolché, gelsemin, fluorescin, turmeric (curcuma), the platino-cyanides and the salts of uranium may be mentioned. Some of these bodies appear to be potentially active only in the solid state, as the platino-cyanides; others, like the salts of uranium, are more fluorescent as solids than they are in solution; turmeric, on the other hand, fluoresces equally well under both conditions; while naphthaline red, esculin and quinine are most active in solution. The fluorescence of some substances only appears when they are suspended in an acid solution, others when dissolved in an alkaline menstrum. The transmutation of the more refrangible rays, effected by turmeric, explains its daily use by the Hindus to protect the skin against the ardent suns of the Tropics. Its use is also enjoined in the "Talbath Rayaol" for a host of eruptive cuticular affections attributable to or aggravated by exposure to the ultra-violet radiations. T. Cattaneo, struck by d'Abbodie's remarks on the effects of sulphur mines on paludism and some observations, published about the same time, on the immunity of earth-eaters from miasmatic disease, conceived the possibility of combining the administration of the sulphates and fluorescent salts of quinine with exposure to light as a cure of malaria. He published seven observations of cases successfully treated by this method, but the discovery of the parasite of malaria and the demonstration of the bactericidal effects of quinine upon it, stopped all further experiments in this direction. The recent attempts made by Morton to incite fluorescence in living tissues by the administration of fluorescent substances open up a large field for discussion, more especially as the effects of luminous radiations upon any but the cuticular structures are unknown. One point, at least, is beyond question, viz.: any light so produced being of a lower order of frequency than the blue rays cannot possibly excite fluorescence in the blood or any other naturally fluorescent tissue of the body.

PRACTICAL LESSONS IN THE TREATMENT OF AFFECTIONS OF THE GASTRO-INTESTINAL TRACT BY ELECTRICAL METHODS.

By George Herschell, M.D., Lond.

(*Continued from page 104.*)

Treatment of Hyperæsthesia and Gastralgia.

In no class of cases can we make more brilliant successes or fail more ignominiously than in the treatment of the painful affections of the stomach by electricity. We shall succeed, for example, if we confine our efforts to attempting to relieve hyperæsthesia of purely nervous origin; we shall certainly fail if we treat cases of ulcer or hypersthenic gastritis, both of which may produce the hyperæsthetic condition. It is therefore necessary to make sure of our diagnosis and exclude these affections before commencing a course of treatment. It is also important to bear in mind that although of great use as an adjuvant, electricity will not stand in the place of general constitutional medication, and thus, whilst we may relieve for a time the hyperæsthesia of chlorosis, we shall not succeed in curing the patient unless at the same time we administer iron or arsenic. This, it is needless to remark, is one of the many arguments why the use of electricity should be kept in the hands of the medical practitioner, who can, whilst using it as a weapon of precision, also employ the other means of treatment which scientific medicine places at his disposal.

For the relief of hyperæsthesia we must of course make use of a form of electricity which will exercise a sedative effect. Of these the chief ones available in ordinary practice are,—

(*a*) **The Sinusoidal Current, Monophase or Polyphase.**—In a degree almost as great as the currents of high frequency these forms of electricity appear to possess the power of anæsthetizing the terminal sympathetic nerve fibres, and are especially useful in the treatment of those cases of gastric hyperæsthesia in which it is undesirable or impossible to pass an electrode into the stomach. If we elect to make use of the triphase current it may be applied in the manner described on page 103. The monophase sinusoidal current may also be used with remarkably good results, and I have records of many cases in my own practice successfully treated in this manner. The apparatus which I have employed on most occasions has been the McIntosh sinusoidal machine which consists of a motor generator group mounted upon a marble base and is provided with a couple of Jewell rheostats. One of these is in the motor circuit and the other regulates the amount of electricity passing to the patient. The output of such a machine

is about 30 volts, the current being of a truly sinusoidal character. When run at high speed the effect has very remarkable anæsthetic properties.

For the relief of gastric hyperæsthesia one electrode should be placed upon the epigastrium and the other one upon the lower dorsal region and the current administered for from 10 to 15 minutes daily until a distinct impression has been made upon the disease. The strength being of course the largest amount of current which the patient can bear with comfort. In using this current we must take as much care of

The McIntosh Sinusoidal Apparatus.

the skin as when applying the constant galvanic one, as distinct electrolytic effects are produced and burns and sores may be easily produced.

(*b*) **The Induction Coil Current of High Tension.**—This is to be applied exactly in the same manner as when treating hyperchlorhydria (*vide* page 103).

(*c*) **The Constant Galvanic Current.**—This is the favourite method employed by Einhorn, of New York, who says (*) "Gastrogalvanization is almost a sovereign means for combating severe and most obstinate gastralgias, no matter whether their origin is of a nervous nature or caused by a cicatrized ulcer of the stomach."

Einhorn's method of application is as follows: The patient having swallowed a glass of water, the intragastric

* "Diseases of the Stomach," Max Einhorn, London, 1898. Page 147.

electrode connected to the negative pole is introduced into the stomach in the usual manner. A small sponge electrode attached to the positive pole is then applied for two minutes to the abdomen just below the ensiform, gradually increasing the current to its full strength. This electrode is then moved up and down the gastric region for three minutes. It is then placed for one minute at the left side of the seventh dorsal vertebra, moved again to the front, where it is moved around the gastric region for one minute and then placed upon the first spot below the ensiform cartilage, where it is allowed to remain for one minute whilst the current is gradually turned off. The current strength should be from 15 to 20 milliampères. One must remember when moving the electrode from one part of the trunk to another not to raise it from the skin, but to keep it in contact with the surface of the body by a firm gentle pressure, otherwise we should exercise an exciting action and produce exactly the opposite effect to that we desire to obtain.

Gastralgia differs from hyperæsthesia insomuch as it is not merely an increase of sensibility of the mucous membrane of the stomach, but a true neuralgia. In by far the greatest number of cases it is really situated in the cœliac plexus and not in the stomach at all, and should, strictly speaking, be termed epigastralgia. As the pain of gastralgia is almost exactly simulated by that of hyperchlorhydria we must make sure that this affection is absent before attempting treatment. We must also remember that neuralgia of the nerve terminals in the stomach may be merely a referred pain and owe its origin to some central irritation or some disease or source of irritation in the main nerve path. We shall thus avoid bringing unmerited discredit upon medical electricity by fruitless endeavours to relieve by its aid the gastric crises of tabes or the referred pain of an aneurism which is pressing on the vagus.

And it is here that the educated physician can score over the unqualified medical electrician by selecting his cases and not using electricity when it can obviously be of no possible value.

For the relief of gastralgia and epigastralgia nothing in my hands has succeeded better than the use of the constant galvanic current applied in the manner advocated by Monell.*

"Seat the patient upon a chair with the clothing loosened about the neck and abdomen. Connect two small electrodes about an inch in diameter with the positive pole of the galvanic battery by a bifurcated cord, moisten the covering with the usual hot water solution of soda bicarbonate, and press them upon the right and left pneumogastric on each

* "The Treatment of Disease by Electric Currents." New York, 1897. Page 686.

side of the neck above the clavicle and between the insertion of the sterno-mastoids. Moisten a felt or sponge-covered flat electrode, about 4 ins. × 5 ins., in the same bicarbonate of soda solution, connect it with the negative pole and have the patient press it over the epigastrium. Gradually increase the constant galvanic current through the rheostat from zero up to a dosage which will afford relief, and when this is apparent maintain the current steadily for a sufficient time—often 15 or 20 minutes. The average dose will vary between five and 15 milliampères."

The following is a good illustration of the beneficial results to be obtained upon properly selected cases:

Mrs. M. B., aged 49, consulted me on January 2nd, 1904, complaining of severe attacks of pain. The pain was referred to the epigastrium, and occurred in paroxysms of great severity bearing no time relation to food. The pain was first felt over a year ago when it followed an attack of influenza. At first, two or three weeks elapsed between the attacks, but latterly they have occurred nearly every day, and have rendered her life almost intolerable. On examination, the pupils, knee-jerks and other reflexes were normal, there was no displacement or dilatation of the stomach, and the stomach contents examined after an Ewald test breakfast showed no deviation from the normal. The patient had a bad attack upon January 3rd and 4th, upon which day an application of the constant current was administered in the manner described above. From this date, there being daily treatment, there was no attack until January 8th, when moderately severe pain woke her up at 6 a.m. and lasted until breakfast. The next attack took place on January 14th, since that date she has been entirely free from pain. The treatment was continued six times a week until the end of January, and three times a week until February 19th, when it was discontinued.

Treatment of Hypochylia and Anachlorhydria.

In cases where the gastric juice is deficient in quantity or digestive power, much may be done by an intelligent use of electricity, provided that the affection is of a purely functional nature and does not depend upon any anatomical cause, such as chronic gastritis, or atrophy of the secreting glands. A correct diagnosis is consequently a *sine quâ non* and a thorough examination of the gastric functions should be made by means of an ordinary test meal, followed by a chemical analysis of the products of digestion. In these cases the best results are undoubtedly obtained by the use of currents of high frequency, but much may be accomplished by the high tension induction coil current used with an intragastric electrode and employing a weak current from a comparatively short length of wire with

slow interruptions. The most suitable coil on the Kidder apparatus will be the 500 yards of No. 32 wire. We may usefully employ on alternate days the constant galvanic current in the same manner as it is used in the treatment of gastric neurasthenia (*vide* page 75). My experience teaches me that much may be accomplished in these cases if we continue the treatment for a sufficient length of time, remembering that our aim is not merely to stimulate the gastric glands which would rather tend to their more complete exhaustion, but to gradually restore tone to the nerve centres which preside over the organic life of the digestive apparatus. During the treatment our progress should be checked by periodical examination of the gastric juice and, of course, the appropriate regulation of the diet and the exhibition of suitable drugs must not be neglected.

The valuable researches of Pawlow have shown us that the extractures of meat are powerful stimulants to the secretion of the gastric juice. Latterly I have been filling the stomach of the patient with a weak solution of Liebig's extract instead of plain water, in the hope of combining this action with the tonic effects of electricity. The method promises well, and is worth trying in obstinate cases, but it is yet too soon to speak definitely as to the results obtained.

SEA-SIDE SANATORIA.—Knopf recommends the establishment of sea-side sanatoria for the thousands of tuberculous and scrofulous children of large cities. New York is especially crowded in its tenement house districts with deformed, rachitic, tuberculous and scrofulous children. He believes that nearly all of them could be cured and made strong, useful citizens and breadwinners, if there were sanatorium facilities for their treatment. He calls attention to the fact that Germany, France, Italy, Holland, and the Scandinavian countries have a large number of sanatoria (with schools attached) for this class of children, and that they report from 50 to 75 per cent. of absolute cures. France alone has 22 sea-side sanatoria for tuberculous children; while America has but one. With her beautiful and extensive sea-coasts, her wealth and many generous philanthropists, they should be established in numbers; for there would be fewer consumptive men and women to care for afterwards. Were it scientific and permissible to call the sea-coast climate in our temperate zones a specific for tuberculosis of the bones, joints, or skin in children, the writer believes he would almost be willing to do so. In a combined aerotherapy, heliotherapy, and hydrotherapy the best results are to be obtained; and in the ozone-laden atmosphere of the sea-shore is to be found a pure aseptic and antiseptic tonic for these cases and for post-operative cases also.—*New York Med. Journal and Phil. Med. Journal,* November 30, 1903.

ON THE METHODS OF APPLICATION OF HIGH FREQUENCY CURRENTS.

By Clarence A. Wright, F.R.C.S.E., &c.

(Continued from p. 111.)

Part II.—Treatment by Effluvation.

As the patient subjected to treatment by effluvation experiences the *static* effects of the discharges, that pass between the electrode and skin, as well as the *dynamic* effects of the currents themselves, it is natural to suppose that all factors that modify the character of the current discharges will have some influence upon the local reaction. Experimental research has proved this conjecture to be correct. In order therefore to obtain a definite *puo sto* for our classification of the methods of local application, we must first consider certain matters having a distinct bearing on the subject. The two fundamental ideas upon which a systemic sub-division can be based are, (*a*) the character of the discharge; and (*b*) the method of electrification of the body of the patient.

(a) *The Character of the Discharge.*—The three forms of discharge that currents in passing between an active and a neutral capacity can assume (that call for particular mention) are *Sparks, Eucomides* and *Effluve.* They are individualized equally as much by their physiological effects upon the tissues treated as by their more purely physical properties; for the alterations arising from variations in the current density at the points between which the discharges pass, and in the dielectric resistance of the air space or media separating them, as well as the differences in area over which the discharges are distributed can easily be shown to have a marked influence upon the local reaction.

Sparks. — The nature and physical properties that peculiarise these *disruptive* discharges are too well known to call for even a passing mention; it must, however, be remarked that, proportionate to the potential of the current employed, its density about the points between which the discharges pass is high, whilst the resistance in the air-space is lowered by the passage of the discharge, which is restricted to a very small area of the cutaneous surface. The local reaction is therefore very intense.

Eucomides.—This term is applied to the delicate violet-coloured radiations that form a luminous sheath about a condenser, vacuum, or fluid electrode when placed in contact with the skin. They occupy an intermediate position between

sparks and effluve, being less painful and ardent than the former and more so than the latter. This can be easily understood, as the current density is more regularly distributed, the dielectric resistance more uniformly proportioned, and the area of distribution greater than in the case of spark discharges.

Effluve.—The finer twig-like ramifications of these brush discharges are seen to the best advantage in a darkened room. They pass out from all points and edged surfaces of the rose, or effluver, when the tension of the current is high—a condition most essential to their production. As the area, over which the current discharges are spread, is large, the local reaction is a minimum. It must, however, be remembered that they exert a peculiar influence upon the sensory nerves and unstriated contractile tissues of the body.

(B) *The Method of Electrification of the Patient.*—In treatment by effluvation the body of the patient may either be a *passive* capacity, electrified by the discharges that pass between it and an active electrode, or an *active* capacity charged by direct metallic connection with a source of high frequency. This difference in the method of electrification has a distinct bearing upon the local reaction; for instance, the discharges that pass out from an actively electrified body to impinge upon any metallic conductor in its vicinity are always far less painful to bear than in the case where the conditions are reversed. It is evident therefore that, relatively considered, we must distinguish eductive from receptive applications and also from bipolar effluvation, which is a combination of the two.

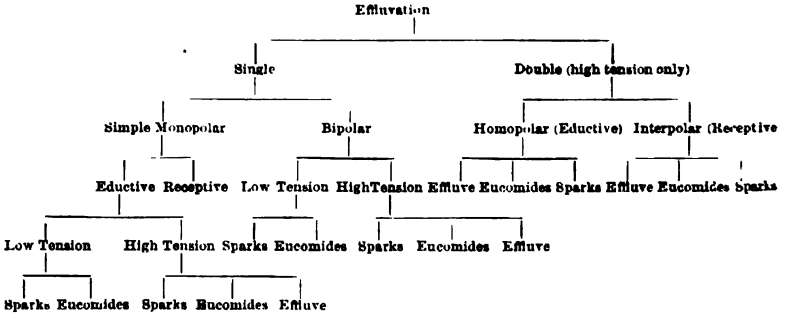
Receptive Effluvation. — This is the most commonly employed method of local application; in it the electrode is the active capacity, whilst the body of the patient is a passive one, directly electrified by the current discharges which pass between it and the electrode.

Eductive Effluvation.—This is the more physiologically potent and less painful method of application; in it the conditions are reversed. An oscillatory current of high potential is first passed into the body of the patient, who is thus placed in monopolar derivation on the circuit, whilst a neutral capacity, such as a many-pointed brush, a condenser, vacuum, or fluid electrode fixed in a *metallic* handle, which is held by the operator, is approached to the part to be treated. A discharge is thus set up between it and the skin, whose nature will, of course, depend on (*a*) the tension of the current; (*b*) the kind of electrode employed; and (*c*) the distance between electrode and skin. It should be remembered that eductive effluvation can, equally well, be practised on patients undergoing treatment by the couch-condenser or by local auto-conduction.

Bipolar Effluvation.—In this method both the body of the patient and the electrode employed are active capacities (in opposite states of electrification) whose mutual attraction creates a zone of increasing density about the interfaces brought in closest relation to each other. In bipolar applications the patient is usually connected with one pole of the small Solenoid of high frequency, or of a Spiral, Cone or Resonator, while the electrode is connected with the other. A variation in technique of bipolar applications consists in causing the current passing into the electrode to first traverse the body of the operator, who is therefore also in derivation on the circuit.

Double Effluvation.—Although this is often confused with the bipolar method of effluvation, it radically differs from it; as it essentially consists in placing a ***neutral capacity***, like the body of a patient, ***between two active spirals or cones, or electrodes connected with opposite poles of a duplex resonator.*** This capacity either receives the discharge from each of these two sources or emits one that passes outward towards them.

We can therefore distinguish several distinct methods of treatment by local applications, as shown in the accompanying table:—



A patient can either be treated by spark or eucomides with currents of low tension; or by eucomides, sparks, or the effluve with currents of high potential, the applications being either unipolar or bipolar (single effluvation) or homopolar or interpolar (double effluvation). For homopolar double effluvation the direction of winding of the convolutions of the two spirals or cones must be the same, in order that the mutual repulsion of the discharges from these two sources while preventing interpolar effects will elicit a discharge from any neutral capacity placed between them. For interpolar double effluvation the two spirals or cones are wound in contrary directions, so that the capacity introduced between them receives a discharge from both, but emits none.

The tension of the currents employed in treatment by effluvation may be either high or low; those of low potential

are derived from the small solenoid or simple coil of high frequency, whilst for those of high tension an Oudin resonator, a d'Arsonval coil of high tension, Guilleminot's spirals, Reus' cones, or a Tesla coil must be employed.

The Solenoid (or Simple Coil) of High Frequency.—The position of the coil in different types of apparatus varies somewhat. In the receptive method of local arsonvalisation, the electrode is connected with one pole of the solenoid by a suitable length of flexible well-insulated copper wire, while the other pole is earthed; in eductive effluvation, on the other hand, the patient is placed in monopolar derivation on one pole of the solenoid whilst an electrode held by the operator is approached to the part to be treated. In bipolar applications both the patient and the electrode are connected with the opposite poles of the small solenoid before being brought into relation with each other. As would naturally be supposed, the *dynamical* effects of the currents are most marked in bipolar applications, scarcely less so in eductive effluvation, and least in receptive effluvation; whilst their *static* effects, on the other hand, are greatest in bipolar applications, less painful in receptive effluvation, and least felt in eductive effluvation. With this source of energy only the brush, roller, condenser, or vacuum electrode are available for treatment, as the apparatus unfortunately allows of no control over the character of the discharge or graduation of its intensity unless a high tension condenser electrode is employed; for otherwise a true effluve is unobtainable, whilst the slightest alteration in the relative distance between electrode and skin is apt to produce a discharge of large white glistening sparks in lieu of the more easily supported eucomides. Owing to the introduction of apparatus by which the tension of the current can be greatly raised, the use of the simple coil of high frequency has been considerably restricted, more especially as these latter improvements allow of a more extensive and finer graduation of effect.

(*To be continued.*)

A SCREEN FOR ULTRA-VIOLET RAYS.—It is stated that Prof. R. W. Wood, of the John S. Hopkins University, has discovered that nitro-dimethylanilin, when combined with cobalt glass, furnishes a screen which permits only the passage of ultra-violet rays.—*The American X-Ray Journal*, Jan., 1904.

Remark.—If this be correct it will afford an invaluable means of sifting out other frequencies and studying the action of the ultra-violet frequencies alone.—THE AMERICAN EDITOR.

1904.

By Dr. W. S. Hedley.

(Continued from p. 115.)

Röntgen Rays. The radio-graphic art is year by year improving in technique and growing in usefulness. Its ambition runs along two chief lines, viz., to get pictures of soft structures and to get pictures of deep structures. Leaving aside the former as not being yet, as a rule, quite within the range of practical work, we have all experienced the difficulty, even with our best tubes, of obtaining clear and well-defined images of the deeper portions of the body—the pelvis, renal and biliary calculi, etc., even after using abdominal compresses and other devices. This indistinctness is, of course, caused by secondary rays, *i.e.*, rays that are produced by the diffusion and reflexion of X-rays in the interior of the tissues, as well as those more evident secondary rays which come from the wall of the tube. The obvious means of suppressing these secondary rays is a diaphragm, but then we must, of course, be content with a smaller picture. To secure a clear picture over the whole plate Mr. Pasche, of Berne, instead of using an immovable pencil of rays circumscribed by a diaphragm (an arrangement which would, of course, affect only a small area of the plate) uses a movable pencil of rays and *two* moving diaphragms.

In the radiography of calculi it is to be remembered, as is well known, and as has recently been pointed out by Guilleminot, that the degree of permeability or transparency of any substance is in inverse ratio to the power of that substance to absorb the rays. This power of absorption is chiefly a question of atomic weight. The importance of volume and density are both much less important than the chemical composition of a substance. It is the chemical composition of a calculus, or rather the atomic weights of its elements, that is the important point. The soft parts—nerves, vessels, muscles, etc.—are transparent to X-rays, ***not*** on account of their lesser density, but because they are formed of organic combinations containing, almost exclusively, hydrogen, carbon, nitrogen, and oxygen, elements of low atomic weight. The bony parts are the reverse of transparent—that is to say, they absorb the rays, not so much because of their density as because of the high atomic weight of their two most important constituents, lime and phosphorus. Consider the principal elements of which they

are composed, and their atomic weights may be tabulated as follows :—

Hydrogen.....	1	Magnesium	24
Carbon	12	Phosphorus	31
Nitrogen	14	Sulphur.....	32
Oxygen.....	16	Potassium	39
Sodium.....	23	Calcium	40

Guilleminot further points out that, according to this, carbonic acid, uric acid, and oxalic acid have, like water and ammonia, very little power of absorbing X-rays, because they have low atomic weights—hydrogen, carbon, nitrogen, oxygen. As to the salts formed by these acids, carbonates, urates and oxalates, their power of absorption increases with the atomic weight of the metal which enters into combination. Thus we can arrange the urates according to their increasing power of absorption—urate of ammonia, urate of soda, urate of magnesia, urate of potass, urate of lime. On account of the high atomic weight of calcium the lime salts have a power of absorption greater than corresponding salts of other bases. In the same way, on account of the high atomic weight of phosphorus, the various phosphates have a notable absorptive power, and the phosphate of lime, owing to the combination of two elements of high atomic weight, possess the greatest absorptive power.

Thus at the bottom of the scale comes uric acid, at the top of the scale comes phosphate of lime. But density does make a difference ; other things being equal, and in spite of its lower atomic weight, an oxalate of lime calculus possesses a greater absorptive power than a calculus of phosphate of lime, because it is much more dense. The greater or less purity of the stone must be considered. Names are generally given owing to the preponderating ingredient, but uric calculi are often mixed with lime. Indeed, it is safe to say that unless they are so mixed they cannot be distinguished from the soft parts.

The whole question practically amounts to this, that unless phosphorus and calcium enter into the composition of a calculus it is impossible to get a radiograph of it. Further, the size being equal, oxalate of lime calculi are the easiest to distinguish, then phosphate of lime; under a certain size, less than a pea, any calculus, whatever its nature, may fail to appear in a radiograph, especially in stout people.

Equalling, if not transcending in interest the technique of radiography are the therapeutic applications of the X-rays. All admit the success that has attended X-ray treatment in a large number of cutaneous affections and superficial malignant disease—lupus, eczema, psoriasis, acne, epitheliomata, rodent ulcer. It is further generally conceded that raying will often

relieve the pain of deep-seated cancer, neuralgia, and other pains, that it may relieve cough in lung disease, and that it can favourably influence the healing and pain of some forms of ulceration.

Cutaneous Carcinoma.—Pusey gives 27 cases (they include rodent ulcer), 21 of which, or 78 %, are to all appearance cured, seven of the number having been well for over eight months; and the cosmetic excellence of the results no one can question.

Lupus vulgaris.—X-rays are now an established form of treatment, possibly in some measure to supersede the arc lamp, and results equal or approximating Finsen's statistics have been claimed.

Eczema, especially of the chronic indurated type, acne, psoriasis, and lichen planus have been successfully treated. As for lupus erythematosus, several successful cases are reported, but all that can be said is that it is as good, or possibly a little better, than other similar agents.

Primary Carcinoma of the Breast.—The following seven cases might represent average results. One symptomatic cure, two died with diminution in the growth, three were checked for the time being, and in one there was no result.

Carcinoma of the Head and Neck—Ten cases: eight fatal, two symptomatically cured.

Carcinoma of Abdomen.—Nine cases: no effect but relief of pain.

Carcinoma of Pelvis.—No satisfactory results.

Carcinoma of Anus and Rectum.—Some relief of pain and shrinkage.

Varney (*Elect. and Radiol.*, Oct.) gives 50 cases of cancer, of which 38 were grave inoperable cases; 13 were sarcoma, 37 carcinoma (18 of the latter epithelioma). Of these 50, 10 ended fatally, five were not improved, eight improved, four sent for operation. Nineteen discharged "clinically cured."

Morton gives 16 cases of various kinds treated by X-ray; all cured but one. Carcinoma two, epithelioma five cured, one failed; carbuncle, lupus, psoriasis, cheloid, acne, alopecia areata, sycosis cured; fibroid of uterus, symptomatic cure, size reduced.

Sarcoma. — Eleven cases are given by Pusey; three symptomatic cures.

Coley thinks that in cases of sarcoma the combination of toxin with X-rays often proves successful when neither agent seems to control it separately. He gives ten cases of different varieties of sarcoma treated by X-ray and toxin injection: (1) Large tumour in right cervical region, clavicle to mastoid; microscopic examination proved round-celled sarcoma, and a mass only about the size of an olive. Patient

left hospital entirely well. (2) Sarcoma femur, metastasis to lung. (3) Small round-celled sarcoma, pectoral region; complete disappearance of tumour. (4) Round-celled sarcoma; fascia of thigh. Treatment failed. (5) Recurrent sarcoma of parotid; patient died. (6) Recurrent melanotic sarcoma of the iliac glands; still under treatment. (7) Spindle-celled sarcoma of under jaw; no result. (8) Round-celled sarcoma gracilis muscle—disappearance of tumour. (9) Small round-celled sarcoma neck—entirely disappeared. (10) Sarcoma of parotid; inoperable—results of treatment promise well. Reviewing the whole position with reference to X-rays in malignant disease, it would appear that in small epitheliomata—for instance, a small well-defined rodent ulcer—the knife is the better procedure, unless, of course, the age of the patient or other things contraindicate it. But in very extensive cutaneous cancer, inoperable on account of size, the X-ray has proved itself useful. Those who have used this method have, perhaps, in their enthusiasm unintentionally magnified their results, and when an author gives 90 per cent. of cures in cutaneous epithelioma we must certainly discount his figures.

Further, it must be well understood that in undertaking the treatment of deep-seated cancer there is reasonable hope of the relief of pain, but that beyond this it is nothing more than a safe and commendable experiment. It is not quite clear by what *mechanism* pain is relieved. The superficial vasomotor dilatation at first produced has been credited with this. But it seems easier to fall back upon some direct action upon nerve terminals or even upon nerve centres. And, *à propos* of this, it has never yet been disproved that a neuritis is the starting point of X-ray injuries.

In cancer of the uterus it is still doubtful whether any permanent benefit has resulted beyond the relief of pain, but it certainly ought to be tried. In cancer of the breast the results are, on the whole, satisfactory, although by no means constant. After operation it is good practice to ray the entire area and its vicinity to prevent recurrence. With reference to raying before operation I hesitate to advise it in the fear that it may exercise some undesirable action on the healing of the wound.

Looking at Coley and Pusey's results there are often good results in sarcoma, especially with the combined treatment. It would appear that it is chiefly on the morbid elements that the treatment exercises any influence. A destructive process beginning at the periphery of the cancerous mass extends deeper and deeper, and this degeneration is of a particular kind. The cell and nucleus lose their form. The vessels become the seat of an active obliterative endarteritis, and the degree of degeneration of the cancer cells is in direct

ratio to the diminution in the lumen of the vessels. Eventually the neoplastic cells disappear, owing apparently to a true cytolysis bringing about their absorption. In the cicatrices Pusey has found only one layer of normal connective tissue covered by a thick epithelial layer, the papillæ having disappeared. According to Pusey the rays act upon the epithelial cells considerably before the vascular lesions occur. He is prepared to admit that these modifications are produced in all the tissues, whether normal or neoplastic, but with different rapidity and intensity.

There were at one time doubts as to whether X-ray burns were really due to X-rays or to electrical discharges, to ultra-violet rays, or other accompaniments of the vacuum tube discharge. It seems to be now experimentally proved that they are due to X-rays, although similar inflammatory lesions can be caused by ultra-violet rays.

The action of raying as a cause of metastasis has not, to my mind, been proved. Degenerative changes in cells and obliterative endarteritis are not, as Pusey points out, changes conducive to the proliferation of the growth. On the other hand, during the process of disappearance of malignant tumours under X-rays, I think I have seen evidence of toxæmia with an occasional rise in temperature, and therefore when a patient, under these circumstances, complains of articular rheumatic pains it is well to be on the alert.

Finally, comparing 1903 with the preceding year, I think it may be said that in the treatment of malignant growths by X-rays, there seems to have been a general advance all along the line, but that no fresh stronghold has actually capitulated to the assault.

Measurement.—In dealing with Röntgen rays, whether for radiographic or therapeutic purposes, the great desideratum is measurement. How are we to know the quantity and quality of the rays we are using? Two instruments have been devised—one, a modification of the so-called radio-chromometer of Benoist, which measures the penetrating power or *quality*; the other, the instrument of Holznecht, which measures the *quantity*. In the first instrument the quality or penetrating power is measured by comparison with a series of relative transparencies of one body to another, *i.e.* of silver to aluminium. Silver is the standard candle, so to speak, and various thicknesses of aluminium are arranged on a scale for purposes of comparison with this. Thus, supposing that with a certain tube, a certain number on the aluminium scale—say 6—corresponds with the shadow thrown by the silver, rays that would give this result, would be designated in point of penetrating power by the number six. (Instrument shown in action.)

(To be continued.)

LECTURES TO MEDICAL PRACTITIONERS ON PHYSICS APPLIED TO MEDICINE.

By Sir Oliver Lodge.

SUMMARY OF LECTURE II.

DETAILS CONCERNING X-RAYS.

(Continued from p. 121.)

Or lastly, the vacuum in an X-ray bulb can be lowered by applying to it more power and over-forcing the bulb beyond the point at which it was excited during the process of manufacture, thus as it were extruding a deep-seated gas, or, more probably, vapourising some of the solid. The tube is thus rendered "soft" for this high power, whereas directly low power is applied it immediately becomes hard again, presumably because the vapourised material has instantly re-condensed. A soft tube has more superficial action, and is therefore more liable to cause dermatitis than a hard one with penetrating rays.

The point or small area of the target on which the concentrated stream of cathode rays impinge is liable to get red hot, especially at low vacua or under great accuracy of fire; and in that case it is sometimes made of osmium, which is more infusible even than platinum, otherwise it may get dimpled or pimpled; so that the walls raised close to the source may thereafter throw undesirable shadows. There is a best position for the target, found empirically by the instrument makers, where the spot is small enough for good definition and yet the fire not so concentrated as to damage the target too much. The bombarded spot is the radiant point, and from it rays proceed equally in all directions, except that the target itself casts a deep shadow behind it.

The X-rays travel in absolute straight lines, being deflected by nothing; lenses, prisms, magnets, electric charges have no power over them, consequently they cast sharply outlined shadows, the sharpness depending only on the smallness of the radiant point. Unfortunately, this point is not quite the only source of rays; the bombardment is not entirely limited to the target; the projectiles are to some extent reflected or emitted from other parts of the cathode, and so strike the glass and other things in the bulb as well as the target, and wherever they strike a small evolution of X-rays is to be expected. Hence in addition to the main radiant point there is a diffuse emission of rays from the whole bulb, which has the effect of slightly fogging or dimming the sharpness of the shadow thrown. For some purposes it is

desirable to cut these stray rays off as much as possible, and several devices have been used. One is to interpose a screen of thick lead glass with an aperture in it for the desired rays to go through. This plan is used by Mr. Martin, of Cardiff Infirmary. Another is to make the bulb itself of thick glass with a tube or window of thinner glass, which may be convenient also for internal application. Such a bulb is advertised by Cossor.

Mr. Mackenzie Davidson uses another plan, available when the bulb is fixed below the patient's couch, for exploration above with a fluorescent screen ; viz., he arranges the bulb in a box lined with a thick coating of red and white lead about an inch thick, with a small aperture at the top for the rays to come through, in which aperture further limiting diaphragms can be placed. The red lead is practically completely opaque, and being an insulator, does not interfere with the current passing through the tube, as a metallic lead box certainly would. For ordinary purposes, however, it is unnecessary to take these precautions, since the radiant point emission is so much the stronger that all other is approximately overpowered.

X-rays are not the only rays emitted by a bulb. It appears that some of the electrons escape through the glass, for if a proof-plane be held anywhere in its neighbourhood, negative electricity can be collected; provided the proof-plane is removed quickly enough, or the bulb simultaneously stopped, so that its ionising power shall not discharge the proof-plane. It may be that these negative charges are due to the induced effect of positive charges inside the glass, which positive charges are creeping back from anode to cathode as they best can ; and it is to give an easy path to these slow moving ions that a supplementary anode or positive electrode other than the target is desirable. But the target itself should always be made one of the anodes, in order to encourage its bombardment by negative electrons. The position of the supplementary anode has been the subject of much experimenting : it has even been placed behind the cathode, a region where the positive electricity tends to accumulate. But that is not the best place for it. The best place has been found by a long series of trials on the part of experimentalists and instrument makers, and the whole bulb has been through a long process of evolution which has resulted at last in the present orthodox forms. Every part of the bulb now has its meaning ; the sleeve in which the cathode is situated, together with the size of the cathode and the amount of space between it and the glass, all represent what has gradually been found to be best. It is necessary to leave a space for the positive ions to creep round and get behind the cathode ; otherwise they will get in the way of the bom-

bardment. The object is to allow a crowd of slow moving positive ions to crawl back near the glass and get to the cathode behind, leaving a clear space in the axis of the tube for the free flight of the real projectiles—the cathode rays or the flying electrons. The current is conveyed conjointly, both by these which move quickly—twenty thousand miles or so per second—and by the probably still more numerous positive ions which move comparatively slowly.

It has long been suspected that some material leaks through the glass during activity, and although is was difficult to suppose that *atoms* could get through, there is no difficulty now in assuming that the fragements of atoms, or electrons, can, some of them, run the gauntlet of the whole thickness of the glass wall; for although most of them would be stopped by an encounter during this journey through a million atoms in series, yet a small proportion must undoubtedly escape; and it is perhaps to this escape of material that the gradual rise in vacuum and ageing of an X-ray bulb is due.

Modes of Excitation.—The steadiest, and in some respects, the best way of exciting a bulb, is by a large static machine; but the easiest and most portable method is by an induction coil, the chief varying element in which is the kind of break used.

These can be classified as:—

(*a*) The ordinary hammer break, which is unsteady and rather slow, and only does for low powers, though it is the simplest of all.

(*b*) The revolving mercury break, which has several forms, all of them depending on the breakage of a circuit between liquid mercury and solid metal, immersed in a vessel full of alcohol or other insulating liquid. Some of these breaks are suitable only to ordinary battery power, and some are safe to employ with the high power of the electric mains; they are in most respects well under control.

(*c*) The revolving dry break, such as that made by Muirhead & Co., with convenient arrangements for varying the speed.

(*d*) The electrolytic or Wehnelt break, depending on the curious property possessed by an intense current when passing from a small metallic area to a conducting liquid, of suddenly stopping or choking itself; by the coating, presumably of oxygen gas, which it instantaneously produces, and which as quickly disperses directly the current is stopped, so that such a break carves a current into a very rapid state of intermittence in the simplest possible manner. It can be used for high power and for a long time together, provided the tank con-

taining the liquid is large enough not to get too hot. Such an electrolytic break is constantly employed by Mr. Hall Edwards, of this city.

Mr. Mackenzie Davidson, on the other hand, prefers not to use the mains—partly, perhaps, because in his case they are alternating mains—but uses an ordinary battery of six or eight secondary cells, together with his simple mercury break as made by Cox. For a country practitioner a battery is the most convenient source of current, and a storage battery can by charged by a small oil engine and dynamo, or it might even by charged by a suitably designed thermopile. Where there are continuous current mains, their convenience forces them to be employed, but it does not follow that they are the best for the purpose. There are certain advantages in having a thick wire primary and a low primary voltage, especially with mechanical interrupters. A current of low voltage can more easily be stopped dead. With a Wehnelt break, however, a potential of 100 or 200 volts is quite suitable.

Alternating currents hitherto have not been serviceable unless transformed, but I see a way to a secondary rectifier which ought to enable them to be directly employed, and in that case no break at all would be necessary in the primary.

The most powerful mode of excitation is by a very high voltage battery, as used by Professor Trowbridge in America, giving 40,000 volts continuous. With less than 10 milliampères current a bulb so excited is extremely bright. At two million volts it seems that air becomes a conductor, and hence flashes of lightning may be of almost any length—several miles easily.

A static machine gives an exceedingly weak current, but its continuous character makes it optically and photographically effective, and it does not strain the tube. It is believed also to be less liable to cause burns and damage—probably because all violence is avoided, and a continuous steady effect obtained, whereas the coil method gives a succession of very bright but very momentary flashes. It is probable that practitioners in the country would find a static machine, driven, say, by a water motor, the best method of obtaining electric power for ray treatment generally.

The frequency of an intermittent X-ray emission can be estimated by rotating a test piece of fluorescent screen rapidly in the dark, and watching its illumination in successive positions. It is sometimes well to do this in order to estimate lengths of exposure, unless the break is a steady one. An electroscopic leak, however, measures total power, and is the best plan of all.

Next time I deal with surgical and medical uses of rays generally.

ANOTHER ELECTRICAL ACCIDENT IN A BATH.

With the fatality at the Fulham Baths still in remembrance a similar accident at East London (South Africa) has a melancholy significance. In the present instance Mr. Ernest Carl Knobel received a fatal shock in a bath, owing to a leakage from the neighbouring tramway currents. The following abstract of the report of the chief electrical engineer to the Railway Department is taken from the columns of the *Electrical Review*:—

As requested, I have now made full investigation into the cause of the recent bath fatality.

The pole nearest to Mr. Knobel's house carries three distinct currents. One, for supplying the arc lights in the streets, had been entirely shut off from the power station some time before the accident happened. The second circuit is that for supplying electric light to private consumers, and is at 110 to 115 volts, alternating current. The tapping for Mr. Knobel's house is taken off at this pole; the lighting wires, first being led to double-pole fuses, fixed to the pole, are run in a 1-in. iron pipe down the pole, across the road underground at a depth of from 14 to 18 in., and terminate at the meter fixed to the outside wall of the front room. Tests proved that there was no defect in the wiring.

The third circuit is that for supplying the electric trams. As the present accident was attributable in some manner to the current from the tramway supply, I carried out experiments under artificially produced conditions, similar to those that existed on the day of the fatality. As it was known that the trolley insulator on this pole burned out about this time, a direct connection was purposely made between the trolley wire and the iron pole and the effects were noted. Measurements were first taken of the pressure, if any, that might then exist between the bath itself and the water pipe, and there was found to be a steady pressure of no less than 400 to 420 volts between the two. A group of five incandescent lamps was coupled between the bath and the tap; these glowed brightly, and the pressure remained the same, proving that very little resistance was present. Tests between the water pipe and the bath waste pipe on the stoep gave 420 volts. From the water pipe to the end of the waste pipe where it emerges from underground into the gutter at the side of the road, gave about 300 volts. Incidentally, this showed the existence of a high resistance in the waste pipe in the length between the stoep and the gutter. To discover what pressure existed between portions of the soil round about, spikes were driven into the ground at intervals. 10 ft. apart and 8 ft. from the pole the pressure was about 10 volts; 17 ft. apart and 20 ft. away, 40 volts; 30 ft. apart and on the side-walk no less than 270 to 280 volts existed, and it was possible to feel a distinct shock when touching the dry earth with the hands separated 2 or 3 ft. On connecting a lamp between two spikes 15 ft. apart

on the side path, it glowed brightly. On communicating with the power station it was ascertained that the current, being generated, was about 114 ampères, with no cars running at the time, so that this current was passing from the trolley wire to the earth round about the pole. The deceased was to all intents and purposes in direct circuit with the trolley wire. The only substances in contact with earth and within his reach whilst in the bath are the wall on one side of bath, the water pipe and tap at one end, and the water pipe and rose above. The wall thereabouts is painted with oil paint to prevent the absorption of splashes of water, and if touched would not have allowed sufficient current to pass to do serious injury; there only therefore remains the water pipe, tap or rose, one of which must of necessity have been touched. As the medical evidence does not disclose any injury to the hand—say, in the form of a blister—it appears probable that the unfortunate man may have touched one of the spikes surrounding the shower nozzle with his head. These spikes are 5 ft. 10½ in. from the bottom of the bath, and may have been within his reach. The experiments proved beyond doubt that the fatal pressure was communicated from the tramway circuit. The iron pipe, on its way to the meter on the house, happened to touch the waste pipe from the bath. On examining the pipe at the place of contact, a small hole was discovered as if burnt through by the current. The bath was thus directly "alive" from the trolley wire.

From the evidence it appears that, immediately after the accident "flames about 2 ft. high" were noticed at the bath tap. This was due to the current having discovered yet another return route, which took the form of the chain wound round the tap and connected to the bath. During this very brief period the conditions must have changed somewhat, because suddenly the chain became a conductor and allowed a fairly strong current to pass between the tap and the bath. This would largely relieve the pressure previously existing, but it was then too late.

The accident must be considered as electrically unique, as an extraordinary series of coincidences must have been simultaneously present, the lack of any one of which would have rendered the original breakdown practically innocuous.

1. Failure of insulator.

2. The electrical resistance between the pole on one side and the water main and rails on the other, though they were so close, being too great to allow sufficient current to pass to operate the safety device in the power station.

3. The direct connection with the pole of a pipe leading into an inhabited house.

4. The connection of this pipe with another leading to the overflow of the bath. It might have been touching the inlet pipe instead, and in that case would have acted as a protection instead of a danger.

5. The outlet pipe being attached to a dry wall for most of its length, and the bath being on a dry wooden floor, were insulated. The insulation would be non-existent were a proper drainage scheme in vogue.

6. The inlet water pipe was directly connected to the water supply. In some cases bath water is obtained from a tank not directly in contact with the water supply.

7. The inlet pipe was not connected to the bath. It frequently is, sometimes by a similar chain to that which came into action, too late on this occasion.

8. A person must be in the act of taking a bath ; and

9. This person must touch the inlet pipe during the time that the insulator is burning.

As the phenomenon of a burning insulator is quickly observed, and it takes but a few minutes to notify the power station, the period during which all the other eight conditions must be present is very short. The only method of preventing a possible recurrence of this danger in future, is to have all poles actually carrying trolley wires and all other poles that may become charged from poles carrying trolley wires electrically connected by a stout copper wire, preferably to the tram rails or to some main water pipe.

It will be well for those who, with a light heart, use street currents for electric water baths to consider the foregoing facts, and ask themselves whether they have taken proper electrical precautions against probable leakage of "current from the main." To explain any and every electrical accident it is usual to hear of "the extraordinary series of coincidences that must have been simultaneously present." It may all be very extraordinary, but the plain fact of the matter is that they can and must all be provided against—separately and collectively.

BREAD AND FRUIT DIET.

Haig recommends a Bread and Fruit Diet as specially serviceable in all those conditions seen "in the collæmic or high blood-pressure group of uric acid food poisonings." He regards the washing-out plan as the height of folly. A dry diet is indicated. Twenty-one ounces of bread stuffs and seven ounces of dried fruits will be the amount and quality of food required in 24 hours. On this form of diet the blood pressure may easily be reduced by 20 to 40 millimetres of mercury in a short time, and the symptoms will disappear, or the patient be greatly relieved.—*Medical Record,* October 31, 1903.

DIGEST OF AMERICAN LITERATURE.

ELECTRO-CHEMICAL SURGERY.

Massey reports a single illustrative case of *Carcinoma of the Breast, Treated by Massive Mercuric Cataphoresis.*

The case is reported a year after a single application. It was a typical one, on the border line of the inoperable, a section of which removed just before the current was turned on, showed the "presence of large masses of closely packed epithelial cells with but few fibres between. Blood vessels were well developed and the original characteristics of the tissue had quite disappeared. Diagnosis Carcinoma." The examination was made at the Philadelphia Clinical Laboratory. The report is illustrated by photographs taken before the operation, immediately after, eight weeks later, after the separation of the slough, six months later, showing healty scar with one doubtful spot and the appearance of the scar at time of the report. The appearance of a doubtful spot in the photograph taken at six months was found to be due to a tiny globule of metallic mercury accidentally imprisoned in the tissues. This was removed, and the tiny sinus sterilized with a single application of zinc mercury cataphoresis 10 M.A. by means of a zinc needle amalgamated with mercury inserted into it. The original operation was done under anæsthesia; a large, well wetted pad to the entire back was attached to the negative terminal of a continuous E.M.F. to the periphery of the growth, and in the enlarged axillary gland zinc mercury amalgam needles were introduced one at a time but from three to four were used simultaneously. These were connected with the positive terminal. A pressure of 160 volts, with a current of 200 M.A. to each electrode, or a total of 720 milliampères at the end of 20 minutes was used. The entire application consumed an hour and a half. A good recovery ensued, and at the end of a year the patient had improved greatly in her general health while the photograph showed an absolutely normal scar. Massey concludes that this method has the following advantages over other surgical procedures: (1) The growth, together with all infected cells, was devitalized at once, without loss of blood, by a process that made operative re-infection of the wound impossible; (2) Any outlying infected cells for a short distance beyond the area of destruction were liable to be destroyed by the diffused chemical without detriment to the healthy tissues; (3) The cancer occupying one half of the breast was destroyed without an entire sacrifice of this organ.—*N. Y. Medical Journal and Phil. Medical Journal,* December 5th, 1903.

[From a very extensive experience in the use of oxidizable metals, copper, silver, zinc, zinc mercury amal-

gam or electro-chemical surgery in a very wide range of suborganized tissue change, from a trachoma to tubercular glands and fibroid tumours, the writer has come to have the greatest confidence in the procedure, and believes that Massey's method should not be confined to inoperable, nor borderland cases, but that it should be given first preference in operable cases. It is as surely destructive as the knife, much more far-reaching, and more conservative.—(AM. ED.)

* * *

ARTIFICIAL FLUORESCENCE OF LIVING TISSUE.

Morton discusses the above subject and its use in the treatment of malignant conditions and Hodgkin's disease. He utilises quinine, esculin, fluorescin, etc., in connection with (1) the Röntgen ray, and (2) radium. Quinine solutions fluoresce outside the body in acid solutions, esculin, froxin, fluorescin, resorcin and eosin fluoresce in alkaline media. These substances are all capable of greater fluorescence when in a very dilute form, which renders their use innocuous. Because of the alkalinity of the blood esculin and other alkaline solutions would seem to be the better ones to use ; but, on the other hand, experiments have shown that the ultimate products of quinine as found in the excretions are still capable of fluorescence. Esculin passes through the organism without being decomposed. The addition of sodium chloride increases its fluorescence. Because of the energy of radiation, blue and violet, which quinine and esculin emit, Morton has used them principally, the former in 5-grain doses, the latter in a dose of a grain, given in dilute solutions, preferably a few hours before treatment. Seven cases have been treated by Morton and under his advice. Five are reported recovered and two dead. One of Hodgkins' disease was under treatment for five months, and had 62 X-ray exposures. He gained 14 pounds, and is considered recovered. Three primary breast carcinomas, one complicated by a recurrent carcinoma in the opposite breast, were similarly treated, and are reported cured to date. In one case four months only had elapsed since first treatment, in another five, and in the third a year. In a case of rodent ulcer of the cheek, 1½ size of a quarter-dollar with continuous discharge and crusts the ulcer healed over with a new skin in 18 days. The sixth case, extensive papillomatous growths in the abdomen had been operated two months prior to coming under treatment. An ovarian tumour, the size of a Derby hat, was found with abundant papillomatous growths attached to various parts of the abdominal peritoneum witb much ascites. No attempt was made to remove the tumour, as the patient was very emaciated and death believed to be imminent. The patient was suffering extremely, when treatment commenced March 21st, 1903, from pain in the left side of the abdomen, paroxysmal, lasting several hours, and causing intense nausea. Urination was difficult, often requiring as much as hall an hour, and the patient was very weak, unable to walk more than two blocks. Five to 10 grains of quinine

bisulphate were administered daily, and exposures to the X-ray, hard tube, 20 minutes each, were made three times a week. In less than a month, the record reads, "not a pain or an ache", able to walk from 10 to 12 blocks without discomfort, to sleep all night, and no trouble whatever in micturition. On June 6th the surgeon reopened the abdomen. He found that both ovaries had been the seat of papillomatous growths, and that these were more scattered over the peritoneum than he had first thought. He removed the primary tumours and handsful of the exuberant mass, along with quarts of bloody ascitic fluid. A 50 per cent. peroxide of hydrogen solution was used, followed by copious washings of saline solutions. She made a beautiful recovery, resumed the X-ray fluorescent treatment during the summer and autumn. Six months later had gained 35 lbs., felt strong and well; no consciousness of abdominal trouble. Morton believes that the violet and ultra-violet radiations within the abdominal cavity were the controlling factors in determining the patient's recovery.—*New York Medical and Phil. Med. Journal*, Feb. 13th and Feb. 20th, 1904.

Remark.—The influence of exposing the diseased peritoneal surface to the air must be reckoned with as well as the fluorescence established by means of the quinine, acting as a radiant energy transformer. In either event the value of light both within and without is emphasised. Röntgen ray treatment alone has yielded equally good results, and the test as to the greater value of fluorescence must be that of time. "It is 30 years since," writes Dr. A. F. A. King, of Washington, in an article upon "Sunlight and Malaria,"* "that Dr. Rhoads and Dr. Pepper demonstrated that in malarial disease the fluorescence of the blood is diminished and that quinine restores the fluorescence to its normal standard." Coincidently with the increase in fluorescence the fever disappears and the patient gets well. The discovery of a fluorescent substance in the blood by Jones in 1866 led to the experiments of Rhoads and Pepper demonstrating that quinine acted in the cure of malaria by increasing fluorescence in the blood of patients. An Italian physician, several years since, administered quinine to his malarial patients, and subjected them to the action of blue light.—THE AMERICAN EDITOR.

* * *

FLUORESCENCE AND TRANSILLUMINATION OF THE STOMACH.—R. C. Kemp calls attention to the internal administration of a fluorescent medium, such as quinine bisulphate, esculin or horse chestnut, and fluorescin in connection with the use of the ordinary incandescent lamp used for the purpose of transillumining the stomach, as per the method of Einhorn. In the use of quinine the bisulphate is preferably selected, and 10 grains are dissolved in eight ounces of water, to which is added five minims of dilute phosphoric acid, as by its use fluorescence is increased. When ready for the examination this is administered to the patient and followed by a glass of plain water (eight ounces). In daylight the colour is a faint violet. The reaction is acid, and it is better as

* *Vedmont Medical Monthly*, June 25th, 1902.

a fluorescent medium than water, but not so good as esculin or fluorescin. With fluorescin ($C_{20}H_{12}O_5$) maximum results are obtained by dissolving it in an alkaline solution. The patient should be examined with the stomach free from food. A glass of water containing 15 to 20 grains of bicarbonate of soda is first administered. This is at once followed by a second glass of water into which has been dissolved from 15 to 20 grains of bicarbonate of soda, one drachm of glycerine, and between one-eighth and one-quarter of a grain of fluorescin. The patient is then taken into the dark room and the electric light introduced into the stomach. A much superior picture is obtained than with the use of plain water, and the size, location, and tumours of the anterior stomach wall are clearly shown. Kemp believes that it will prove an aid in differentiation of tumours of the liver and intestines. In obese patients transillumination thus becomes a fact where before it was impossible. Two such patients were examined with brilliant results. No symptoms whatever follow the use of the fluorescin. As the solution becomes more fluorescent upon exposure to light it may be prepared beforehand and exposed to light for several hours. Kemp suggests that the genito-urinary specialists will find in fluorescent substances a great aid in connection with cystoscopy.—*The New York Med. Journal and Phil. Med. Journal*, Feb. 13th, 1904.

Remark.—Without question it is the day of light. Not only for the purpose of transillumining interior organs but for their treatment as well, fluorescent substances and lamps for internal use may be employed. In some of the diseased conditions of the bladder fluorescent cystoscopy might become the therapeutic as well as the diagnostic agent. In vagnitis simple or specific, in endometritis cystic conditions, and judging from the action of light elsewhere, even in septic conditions, the light treatment, for example, with a vaginal lamp, such as was described recently by the writer,* can be supplemented by the use of fluorescent materials. Fluorescin, quinine, esculin, etc., are radiant energy transformers—that is, they absorb energy of radiation at one wave-length and emit it at another. The colour which the fluorescent material takes on is governed by the rate of emission. Quinine and esculin, for example, fluoresce with a violet colouring, indicating that they emit energy of radiation equivalent to frequencies of the visible chemical region of the spectrum. It is probable that quinine also emits an energy of radiation at ultra-violet frequencies. Fluorescin emits at a wave-length corresponding to the green. In the same way radio-active substances may be used—radium, for example—but the writer questions any effect whatever, either for purposes of transillumination or as a medicinal agent from radio-active water when taken internally. If used as a lotion (conjunctivitis) as a vaginal douche a rectal or a vesical injection there should follow beneficial results. In this event, however, it must be used promptly, as induced radio-activity falls to one-half its value in 28 minutes, according to Thomson.—THE AMERICAN EDITOR.

* *Medical Electrology and Radiology*, Oct., 1903.

PART II.

PROCEEDINGS OF THE BRITISH ELECTROTHERAPEUTIC SOCIETY.

Edited by CHISHOLM WILLIAMS, F.R.C.S., Ed.

MARCH 25th, 1904.

The Twentieth Ordinary Meeting was held at 11, Chandos Street, Cavendish Square, W. The President, Dr. LEWIS JONES, occupied the Chair.

Present:—15 members and three visitors.

The minutes of the Nineteenth Meeting were read and confirmed. The Town Honorary Secretary read the names, etc., of five candidates for membership.

The ballot was then taken and proved unanimous in favour of the following gentlemen: John O'Donnell, M.D., 3, Merrion Square, Dublin; Joseph Riley Ratcliffe, M.D., Wake Green, Moseley, Birmingham; William Steele Haughton, M.D., 30, Lower Fitzwilliam Street, Dublin; Joshua John Cox, M.D., 38, Deansgate, Manchester; William Martin, M.B., 17, Windsor Place, Cardiff.

Dr. DONALD BAYNES then showed the a severe case of osteo-arthritis. *See case 1, end of Dr. Bayne's paper.*

Dr. H. DONALD REID exhibited a lead diaphragm tube box, and skiagraphs taken with its aid.

Dr. LEWIS JONES agreed that diaphragms of lead were of great help in sharpening the focus. He thought the blurring was due not only to stray rays produced during the direct discharges, but even more to those produced during the back discharges traversing the tube in the wrong direction. He thought that the excellence of static photographs was due to the absence of these discharges in the wrong direction. The importance of these considerations is evident because the tendency to use high E.M.F. for exciting X-ray coils is a growing one, and with this, and with electrolytic breaks especially, the discharges in the wrong direction assume a very great importance, and tend to spoil tubes rapidly. Indeed, he thought that very soon operators would be using auxiliary choking coils in the primary circuits of X-ray coils to combat the bad effect of the wrong-way discharges.

Mr. HALL-EDWARDS agreed with Dr. Reid in the importance of limiting the area of the rays by means of a diaphragm. Suggested that the box containing the tube

should be provided with opaque sides in order to protect the legs of the operator. For the radiographing of hip-joints and stones in the kidney a diaphragm is almost a necessity.

Mr. CHISHOLM WILLIAMS showed a tube shield, made of thick lead glass for therapeutic purposes as suggested by Dr. Reginald Morton.

Mr. CHISHOLM WILLIAMS also showed an improved form of the Oudin-Dean Resonator. The improvement consists of a device, by which the milliampèrage is considerably increased. This is effected by stopping all resonance whilst using the small solenoid. The usual output of this class of machine is from 250 to 300, with Leyden jars as condensers, with this improvement 450 to 500 is readily attainable.

The second high frequency machine exhibited was Dr. Batten's, which has been demonstrated by him before this Society. It is an induction method of producing high frequency currents, using flat copper bands, thereby reducing the impedence effects of closely placed wires. The jars are placed underneath, and is practically noiseless. In Dr. Batten's own words, "it is improved almost beyond recognition." It is now provided with an ingenious device for increasing the milliampèrage without shock to the patient, even whilst in connection. These new machines both mark an advance on this point. A switch is now conveniently placed, by means of which we can now turn from "auto-condensation to effluve" without undoing any terminals. Another form of resonator was to have been shown whose output to the auto-condensation couch measures upwards of 1,000 milliampères. Mr. Williams promised to show it at some future meeting. Both machines and Dr. Reginald Morton's tube shield were manufactured by A. E. Dean.

Dr. DONALD BAYNES then read his paper on "The Electrical Treatment of Gout and Rheumatism."

Mr. President and Members of the British Electrotherapeutic Society,—A few days ago our secretary wrote asking me to read a paper at this meeting, as the member whose name was down as reader found he could not be present. Although the time at my disposal was very short, I accepted his invitation as I wish to bring before you what I consider a distinct injustice to that branch of therapeutics in which we are interested. It is doubtless in your recollection that the editors of the *Practitioner* last July devoted an entire number of the journal to the subject of gout and various forms of arthritis, and ear-marked it "Special Gout Number." This number, as you are aware, consists of a series of valuable papers, written by well-known experts, the whole being under the able editorship of Dr. Clifford Allbutt. These instructive

monographs give us in a clear and pleasing manner all the most modern views on the causation, origin and pathology of gout, and, though the opinions of the various writers are somewhat divergent, still, with this part, the most censorious of critics will find little or nothing to criticise. When, however, the subject of treatment is dealt with, we find with surprise that this most potent of remedial agents is practically ignored. Half-a-dozen lines or so sums up the knowledge or interest in electrotherapeutics of those responsible for the description of the various remedial measures in vogue. When we consider the value of galvanic and static phoresis in the reduction of the enlarged or diseased joints, so common in gout and rheumatism, the certain beneficial action on the faulty metabolism of high frequency currents and the perfectly well-known curative effects of properly administered electrical treatment, in all diseases of this class, we are more and more surprised that no place was found for electrotherapy in a number which is specially devoted to the pathology and therapeutics of gout—that is, if the editors of the *Practitioner* wished to make this number thoroughly complete. Considering the important position electricity holds in the treatment of gout, rheumatism and allied diseases, and the fact that it is hardly mentioned in a series of papers, such as the July number of the *Practitioner*, is my object in reading this paper.

Though electric currents may owe their source to various causes one thing is noticeable, that no matter what their source, they all produce the same effects, viz., physical, chemical, and physiological, and pathological. The physical effects are magnetic, mechanical, thermic, and dynamic. The chemical effects include electrolysis, phoresis and polarization. These phenomena play a large part in the local treatment of all joint affections. The physiological effect is too large a subject to enter upon at any length. I may, however, mention that the general effects on the human body are (*a*) functional and (*b*) molecular, and these are combined in different proportions according to the current used. With the galvanic current we get the greatest molecular and the least functional effects. On the other hand, a static discharge produces the greatest functional and the least molecular action; while the induced current holds a place midway between the two. High frequency currents are closely related to those produced by influence machines. Their actions on the vasomotor system are very marked. The blood pressure is lowered at first, but soon rises and remains so, and their effects on assimilative and nutritive changes are also very noticeable. The heat of the body is increased, the absorption of oxygen, the elimination of carbon dioxide is promoted, the output of sugar in diabetes and uric acid in gout and rheumatism is under the absolute control of these currents. I

will now (after this digression on the general action of electrical currents) proceed with my subject.

In the treatment of these affections, the general health and condition of the patient will require quite as much attention as the local manifestations, though it is for the relief of the latter that our assistance is usually required. For the former, general applications are necessary; for the latter, local. Among the various methods for giving general applications, I may mention central galvanization; galvanic currents of great intensity; electric baths of various kinds, medicated or plain; static insulation or static baths; high frequency currents (auto-condensation); and general faradization.

For the local treatment, stabile applications of the galvanic current to the joint are very useful in promoting the absorption of exudates, and may be considerably helped by labile applications to the tissues surrounding the joints of galvano-faradism. Galvanic and static phoresis give the best results. Static sparks and high frequency currents, locally applied, all have their place. Personally, I like giving one or other of the above methods, both general and local, on alternate days.

As phoresis plays so important a part in the local treatment of joint affections, I may be excused if I describe it in detail, although I have already done so in a former paper.

By phoresis we mean the introduction, or passage of fluids, or crystaloids in solution, through a tissue (such as skin or mucous membrane) or porous septum by the agency of the galvanic or static current. Galvanic phoresis includes two distinct and separate phenomena known as anaphoresis and cataphoresis, and is either one or the other as the diffusion takes place from the anode or from the cathode.

It is found by experiment that some drugs are carried into the tissues more rapidly than others; for instance, the diffusion of alkalies is much more rapid than that of the acids, so also some alkalies are diffused more quickly than others, and the same may be said of the acids. Phoresis is practically an electrolytic process, as the drug acted upon by this method is broken up into its elements, some going to the negative pole and some to the positive, according as they are electro-negative or electro-positive. This action necessitates a classification of drugs into electro-positive and electro-negative. The following are a few of the drugs or medicaments that come under the class electro-positive, alkalies as a rule; hydrogen, potassium, sodium, copper, zinc, cocaine, gelsemium, jaborandi, ichthyol, iodoform, etc., and of course all these have a strong affinity for the negative pole. Among those classified as electro-negative I may mention the following: the acids, or what takes the place of an acid, oxygen, chlorine, nitrogen, iodine, fluorine, sulphur, and

many others. These manifest a strong affinity for the positive pole. When dealing with binary compounds—by these I mean such drugs or medicaments as are composed of two elements, a base and an acid—we find that the base is electro-positive and the acid, or what takes its place, is electro-negative. Take, for example, cocaine hydrochlor., here cocaine is the base, and as stated above in binary compounds, the base is electro-positive and must be applied by or from the positive pole, which repels and transfers it to the negative pole. But suppose instead of cocaine hydrochlor. we are dealing with iodide of potash. In this case the iodine taking the place of an acid is electro-negative, and must be applied by or from the negative pole, which will repel and transfer it to the positive. We may therefore formulate the following rule, which in practice will be found to be fairly accurate, viz., in binary compounds the base of the salt must be introduced by or from the anode, whereas the acids, or what takes the place of the acids, must be introduced by or from the cathode. Now as the dose or quantity of current required in phoretic applications and the duration of each sitting depends to a greater or less extent on the amount of work to be done, each case must be treated on its merits, although always bearing in mind that if too strong currents are used, or if continued too long a time the acids of the body will accumulate to such an extent, at the analectric zone, as to nearly, if not entirely, destroy the drug, and thus neutralise its effect.

The following experiments conclusively prove (*a*) that drugs can be introduced into the system, even in poisonous doses; and (*b*) that electro-negative medicaments have an affinity for the positive pole, and must be applied by the cathode, which repels and drives them towards the anode, while on, the other hand, electro-positive substances must be applied by the positive pole for a similar reason. For instance, if we take two carbon electrodes, covered with absorbent cotton wool connected with a galvanic battery, soak them in a solution of methylene blue and apply them to the arm or any part of the body. Now if a current of from 10 to 15 m.a. be allowed to pass for from 15 to 25 minutes, and the electrodes be then removed, we will find that the methylene blue beneath the anode has entered so deeply into the pores of the skin, that it cannot be removed by washing, while the stain beneath the cathode is easily wiped off. The colouring matter in thus leaving the anode, and seeking the cathode has passed into the skin, and must be electro-positive, and the action is cataphoric. But if, instead of methylene blue, we use a solution of eosin, the permanent stain takes place below the cathode; eosin is therefore electro-negative, and its action is said to be anaphoric. Professor Leduc's experiments with rabbits are very instructive. He took two rabbits and con-

nected them together, using for the connecting electrode simply a saline solution, on the outer side of each rabbit he applied an electrode soaked in a solution of sulphate of strychnine. A short time after the current was turned on, the rabbit in connection with the *positive* pole died, being poisoned by the strychnine, while the second rabbit was unharmed, it being attached to the negative pole only received the sulphuric acid of the solution. Dr. Leduc then removed the dead rabbit and substituted a living one in its place. He then repeated his experiment, but this time used cyanide of potassium, with the result that the rabbit connected with the *negative* pole died being poisoned by the hydrocyanic acid. The other only receiving a certain amount of potash did not suffer any harm.

However useful galvanic phoresis may be, it is only applicable to watery solutions of drugs. When, therefore, we wish to obtain the phoretic effects of gaseous, volatile, or volatisable substances, we must have recourse to the static current. This is carried out by means of hollow cylindrical or globular glass electrodes, at one end of which is a discharge brush, connected with the machine and so regulated that it can be pushed forward or backward and thus brought nearer or further from the opposite end of the electrode which is open and in contact with the skin. Pellets of cotton wool soaked in the volatile medicament, such as salicylate of methyl, is placed in the tube at the open end, which is then put in intimate apposition to the part to be treated.

In the case of such a substance as mercury, the drug must first be volatilised by heating it in a retort, the vapour being carried from the retort to the electrode by rubber tubing, which fits over a perforated glass nipple connected with the electrode. Gases are introduced into the electrode by rubber tubing extending from a stopcock attached to the jar or pipe containing the gas, to the glass nipple opening into the electrode.

During the process of static phoresis the patient must be on an insulated stand attached to the negative pole.

The therapeutic possibilities of this method of phoresis are very great, and the known beneficial results in phthisis, tuberculous joints and glands ; gouty, rheumatic, and arthritic joints, ulcers, unhealthy sores, sinuses, many affections of the nasal and other cavities, certain skin diseases, etc., are such as to warrant fuller investigation.

For static phoresis it is absolutely necessary, in order to ensure perfect penetrations, to use instruments that run at a very high rate of speed.

Having considered the general aspect of the electrical treatment of these affections, I propose now to say a few

words on the special technique to be followed in gout and rheumatism.

GOUT.—Here we have to deal, roughly speaking, with a condition of faulty or retarded nutrition, and an incomplete oxydation of nitrogenous matter, resulting in an excessive production and retention or accumulation of uric acid in the system, which in turn produces or is converted into the urates of soda and lime. These salts are excessively insoluble, and though they may be deposited anywhere in the body are usually found in and about the joints and are known as tophi.

The general or constitutional condition and the defective metabolism may be most successfully treated by either high frequency currents, or galvanism, employing currents of great intensity, after the plan suggested by Guilloz. This method is carried out by applying large, well-covered electrodes over the abdomen, thighs, buttocks and loins. The electrodes attached to the negative pole should be somewhat larger than those connected to the positive; they must be thoroughly moistened. The strength or intensity of the current is gradually carried to 150 m.a., beginning with 80 m.a., then raising it to 120, returning to 100, and so on till the patient can bear 150 m.a.; sometimes even 200 can be reached. These applications are continued for 20 minutes at first, but eventually the sitting may be continued for half to three-quarters of an hour. If the skin gets tender, shift the position of the electrodes.

The increase of urea, uric and phosphoric acids found in the urine after a few days' application of the high frequency currents is very marked. The plan I usually follow is to apply these two forms on alternate days. The improvement in the patient's general health is very great, after even one week's treatment. The technique of the local treatment may be carried out in one of two ways, either by pledgets of blotting paper, lint or absorbent cotton soaked in a strong solution of iodide of potash. One such pledget to be placed on either side of the joint to be treated. Over each of these pledgets a small flexible metallic electrode is placed. They should be somewhat smaller than the medicated pads. These are connected one with the anode and the other with the cathode of a galvanic battery. The current is now turned on, as strongly as the patient can comfortably bear. The iodine of the pot iod will enter the joint at the anode, while the potassium will enter at the cathode after three or four minutes, or, in the case of the knee joint, five or six minutes. Reverse the current, and the side of the joint that was receiving the iodine now gets the potash, and the side that was treated with the alkali (potassium) now receives the acid (iodine).

Another method is by filling an earthenware jar with a solution of one of the salts of lithia. A carbon electrode con-

nected with the positive pole of a galvanic battery is placed at the bottom of the jar. The affected joint is then immersed in this solution, the circuit being closed by large well-covered electrodes, which are placed on the back or buttocks. Very strong currents can be used in this manner, varying from 50 to even 200 milliampères. The above is the technique employed in the treatment of most forms of arthritis, gouty rheumatoid, rheumatic, etc. For tuberculous and scrofulous joints static phoresis is often to be preferred, as by this method mercury and other substances, impossible to massage by galvanic phoresis, are easily introduced into the joint.

Sparking from an influence machine or from high frequency current apparatus has an excellent tonic effect in some joint affections.

In *Articular Rheumatism* the treatment would be the same as described in the treatment of gout and gouty arthritis.

In Muscular Rheumatism, including torticolis, lumbago, etc., the muscles are affected. In these cases electricity as a remedial agent stands head and shoulders above any other method of treatment and may be given in the form of electric baths (galvano-faradic and sinusoidal), static insulation followed by the static breeze, and high frequency currents (auto-conduction) to be followed locally by massage, the operator having one terminal of a high frequency current apparatus attached to his wrist by a wristlet, while the other is connected to the head of the couch on which the patient is reclining, sparking from an influence machine, or ordinary local applications of the galvanic current or galvano-faradic current combined, sums up the usual methods that may be adopted in these and similar cases.

I will now close my paper by giving two or three cases of the results that may be obtained by systematic electrical treatment.

Case 1.—L. T., which I have brought before your notice this evening, was a cook until her infirmity prevented her continuing her occupation. She is 38 years of age. Three years ago her right finger joints began to swell, and became painful, then the right shoulder became painful, the wrists, both right and left, were next attacked, then the knee joints, and, finally, the ankles and elbow joints. The attack was accompanied, and probably preceded, by an intestinal catarrh, characterised by diarrhœa, which was sometimes better and sometimes worse. When this catarrh was better the pains in the joints were worse, and *vice versâ*. She was eight weeks at Bath Hospital, a month or six weeks at a sanatorium at Weston-super-Mare. She also tried the various other treatments in vogue: heat, etc. In spite of all she gradually got worse. I saw her for the first time, the 18th of February, 1904, at the request of one of my patients, in whose

service she once was. At that time she could only hobble about with help. She could not sew, or even turn the handle of a door, and was always in pain, which kept her awake at night. She can now sew very well, and, as you see, walks easily across the room. The last time she came to my house she walked home, a distance of nearly a mile. The swelling of the joints has considerably decreased: two inches in the right wrist, 1¾ in the left, the right knee is reduced 3¾ inches, and the left 3¼ inches. One peculiarity I have not previously noticed in any of my patients was a distinct thickening of the sternum at the junction of the manubrium and gladiolus. This thickening was about the size of a goose-quil; it has now quite disappeared. Her general treatment has been central galvanization and high frequency currents on alternate days. The local treatment has been simply daily phoretic applications of iodide of potash, as described above. This has been carried out by a nurse under my direction.

Case 2.—Married, has several children, and was for some time in India, where she had an attack of sciatica. On her return to England, she went to live in a damp part of the country, and the house turned out to be damp and the drains bad. This state of things induced a severe attack of sciatica and pain over the lumber region. The attack came on in February, 1903, after various kinds of treatment in this country. She went to Aix-les-Bains in May, 1903, where she had the baths and also the other methods of cure in vogue at that place, but without avail. She then went to Switzerland for more treatment, the pain still continued, and was always worse at night. The only thing that gave her relief was asperin, but this produced obstinate constipation. When I saw her in August, 1903, she was in considerable pain, and was bent very much on one side—in fact, she could not stand upright. I stopped the asperin and the bowels then began to act naturally. Her treatment was simply high frequency for 10 minutes on the couch, followed by massage over the back and legs, the wrist being attached to the apparatus by means of the wristlet, which was joined to the cord which had been removed from the bottom of the couch. The effluve from the top of the resonator was used from time to time. She had this treatment twice a day for three weeks. Before the end of this time the pain was quite gone; she was able to stand straight and walk without her stick, and up to the present time she has remained quite well. There was in her case, though not connected with the attack of sciatica, the peculiar condition, on closing her hands when holding anything, the second fingers remained bent when the hands were opened and had to be gradually drawn straight, and returned to their proper condition with a click (trigger fingers). This

peculiarity had practically passed off before she left my care, though no special treatment was directed towards their cure.

Cases 3 and 4.—Very similar in character. Men of between 50 and 60. The knuckles and toe-joints were enlarged and nobbly from gout. Their family history was distinctly gouty. These cases were treated by putting the feet and hands into jars containing a warm solution of one of the salts of lithia. The jars for the feet were connected to the positive pole by a suitable electrode inserted into the jars, and those in which the hands were placed were in connection with negative pole. Strong currents, 80 to 120 m.a., were used for about 15 minutes; the current was then reversed, and the feet had the current from the negative pole and the hands that from the positive for the same time. These patients also had high frequency currents. Their general health soon improved, and the swellings about the joints were gradually reduced. I could give many more such cases, but those I have mentioned are ample for the purpose of this paper, and they are among my more recent cases. In conclusion, I may say if the contents of the jars used in a process such as I have just described be chemically examined, uric acid, oxalate of lime, and other organic matter will be found.

Dr. LEWIS JONES congratulated Dr. Donald Baynes upon his paper, and thanked him on behalf of the Society for coming forward at so short a notice with a paper of such interest. He believed that the introduction of medicaments by electrolysis was worthy of much more study than it received. Dr. Leduc, of Nantes, had recently published some very interesting points in connection with the effects of the introduction of ions into the tissues. Among others he had reported the complete cure of a case of rodent ulcer by the introduction of zinc ions, using an anode of zinc wrapped in cotton wool, wet with zinc chloride solution. There was only one application, but the rodent ulcer had disappeared. Another experiment of Dr. Leduc was to connect two rabbits by a large pad of moist wool, and to apply an electrode to each of them. If both electrodes were wetted by a solution of strychnia sulphate the rabbit at the anode was poisoned by the strychnia ions migrating in from that pole, the other rabbit received only SO_4 ions, and was unaffected. If cyanide of potassium was used to moisten the electrodes, the kathodal rabbit died through the migration of cyanogen ions inwards from that pole, the other rabbit received only potassium ions, and escaped. These experiments showed that electrolysis rather than osmosis was the agent acting to transport the X-rays.

Dr. DAVID ARTHUR had great pleasure in congratulating Dr. Donald Baynes on the excellent results he has obtained in the case of arthritis deformans shown ; also on his paper on the treatment of gout and rheumatism.

Has he ever observed that an initial large dose of high frequency current will precipitate an acute attack of gout in a susceptible case? I remember losing a patient through committing this error; evidently the electricity eliminates from the tissues more uric acid than the kidneys can excrete, and the excess brings on an acute attack of gout. Personally, I begin with small doses, which I increase, if the urine keeps free from deposit.

I have not applied potassium iodide by cataphoresis as Dr. Baynes has done ; but I should think his method will act well ; as I have got very good results by giving potassium iodide by the mouth, and galvanic massage over the enlarged parts.

Dr. GEORGE B. BATTEN thanked Dr. Donald Baynes, and asked him how he would treat those quite common but extremely tedious and painful cases, of what Sir Wm. Gowers has recently described very vividly, *i.e.*, cases of rheumatica fibrosa ; especially those cases in which chronic thickenings are left in fibrous tissue, as in cases of lumbago and sciatica. Dr. Batten had found that high frequency and other electric treatments sometimes made patients very tired, and so made their general condition worse instead of better. Dr. Baynes briefly replied, and the meeting then concluded.

NOTICES.

Members taking part in discussions or making remarks on papers, etc., are earnestly requested to give their notes on same to the Secretary at the end of evening, so that the proceedings may be complete and not delay the prompt publication of the Journal.

Members are reminded that the annual subscription (one guinea) became due January 1st, and should be sent to either Honorary Secretaries at their earliest convenience.

The Secretaries will be pleased to hear from any member willing to read a paper, etc., at any future Meeting. The dates are: April 22nd, May 27th, June 24th, July (Oxford, business only), September 23rd, October 28th, November 25th. December (Exhibition).

COX'S

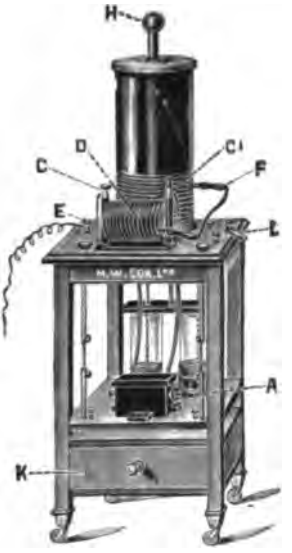
HIGH-FREQUENCY

D'ARSONVAL and OUDIN'S.) **APPARATUS.**

With Special Handle Electrodes designed by Dr. Chaplin.

New List giving full particulars will be ready shortly.

Full instructions sent with each Apparatus.



X-RAY APPARATUS

Of the Highest Quality & Finish only.

Human Hand, Showing Amputated Forefinger.
Reduced from 10 by 8 plate,
with consequent great loss of detail.

We are the Actual Manufacturers, and guarantee every Coil against breaking down.

*

JUST OUT:

COX'S NEW ELECTROLYTIC INTERRUPTER.

(Patent applied for.)

Will work off 24 or 200 volts.

Price: **50s.**

MR. MACKENZIE DAVIDSON'S MERCURY INTERRUPTER.

(SOLE MAKERS.)

(With Latest Improvements.)

New Pattern, Price: **£6 16s. 6d.**

*

Lessons given in Management of X-ray and H.-F. Apparatus.

HARRY W. COX, Ltd.,

Manufacturers of APPARATUS FOR X-RAYS, HIGH-FREQUENCY, &c.

As supplied to H.M. Government, including the Admiralty, War Office, Colonial Office, India Office, and Post Office; also the leading Hospitals and X-ray workers throughout the world.

9, 10 & 11, Cursitor St., Chancery Lane, LONDON, W.C.

Our new Catalogue is now ready and will be sent to Hospitals and Medical Men on application.

NOTES AND ABSTRACTS.

THE SOLAR CAUTERY.—Dr. O. V. Thayor contrasts other methods of treatment for malignant growths with his solar cautery. During the last 30 years he has operated more than 2,000 times with concentrated sun light and has yet to find any case of injury from it. Unlike other caustics and cauteries, it can be applied to delicate membrane or tissue, and inflammation following its application is surprisingly slight and of short duration. The pain subsides immediately upon removal of the lens. Blistering is avoided, as the burning is carried beyond that point. The abnormal tissues are carbonised. The success of the operation depends upon the destruction of all the morbid growth treated. Thorough dessication of the tissue must be established before cremation takes place. After a few minutes' application the fat in the tissue is melted, and effusion of serum increased. This prevents further destruction, and the parts are allowed to cool before concluding the operation. Dressings are then applied to thoroughly protect the part from the air. Carbonised material is thrown off after three or four days, leaving a healthy sore, which is treated as any other wound. The cicatrices are very slight. The claims for this method are less pain, fewer treatments, less constitutional disturbance, and greater probability of cure than by any other method.—*The Pacific Medical Journal*, Sept., 1903.

Remark.—This method would not be possible save in such a land of sunshine as California.

THE NERNST LAMP FOR THE PRODUCTION OF ETHER WAVES, FOR USE IN THERAPEUTICS.—After calling attention to the value of the arc lamp as a source of the maximum short and high frequency waves or ultra-violet light, Rollins calls attention to the Nernst lamp for therapeutic purposes. Although this lamp is supplied with a glass covering, it is not necessary that it should have one, therefore there is no loss of the short high frequency waves or ultra-violet light. Where an even distribution of radiant energy is required, as in a therapeutic cabinet, numbers of the Nernst lamp might be used in place of the incandescent lamp now in use. In the Nernst lamp less of the current is converted into the longer heat waves than with the incandescent lamp.—*Boston Medical and Surgical Journal*, vol. CXLIX., No. 2, 1903, p. 37.

VALUE OF CLIMATE IN GENITO-URINARY TUBERCULOSIS.—W. H. Prioleau believes that equally beneficial results may be obtained in patients suffering from tuberculosis of the genito-urinary organs as in those suffering from pulmonary tuberculosis or other tuberculous affections, providing the condition is recognised sufficiently early. Extremes of climate are unsuited to such cases, and they usually do best in an equitable climate in a moderate elevation similar to that which is to advantage in pulmonary tuberculosis. A patient with tuberculosis of the kidney should never be sent to an extreme altitude for, by reason of the elevation, the heart's action is increased and more work is thrown upon the inflamed kidney, and thus the benefit which otherwise might accrue is inhibited. The patient's diet should be properly regulated at the same time.—*Medical News*, Jan. 9th, 1904.

MEDICAL

Electrology and Radiology.

No. 5. MAY, 1904. Vol. V.

EDITORIAL.

Although fluorescence is commonly associated with light rays, it must be remembered that these ethereal vibrations are not the only agencies capable of initiating it. The same phenomenon is seen to even greater advantage when a stream of cathodic rays—the negatively charged particles of electricity of Sir Oliver Lodge—impinges upon a fluorescible substance introduced into the interior of a Crookes' tube. The experiments made in the year 1900 by Thomas Tommasina has extended our knowledge of the effects of electrical discharges on fluorescence. He has clearly proved that currents of high potential, in passing between electrodes of aluminium or magnesium through a glass tube filled with water or alcohol, give rise to similar luminous effects. The fluorescence so produced is not only sufficient to illuminate the interior of the glass tube and its contents, but also to render visible all objects in its immediate vicinity. The degree of luminosity depends on the intensity of the current, its constancy on the source from which the current is derived. With a static machine a continuous steady effect is obtained, whereas with a spark-coil a bright but pulsatory illumination is produced; the number of flashes being proportionate to the frequency of interruption of the flow of the current in the primary circuit. The extra current at "closure" renders luminous the anode, that at "break" the cathode, thus proving that the fluorescence is anodic. The light so produced is incapable of exciting a platino-cyanide screen, but is photo-chemically active. The effects are best seen when the surface of the electrodes is unpolished and somewhat oxidised; the film, which acts as a dielectric, appears to be excited to fluorescence by the passage of the current. The luminous effects can be further increased by the use of alcoholic solution of quinine or gelsemin, of the glycero-alcoholatures of quinine, gelsemin, turmeric, or of aqueous solutions of the same substances, or of esculin, fluorescin, and eosin. These observations are of special interest and not lacking in practical possibilities, as currents of high frequency of sufficiently great potential and ampèrage will no doubt be found to be equally as effective in exciting fluorescence.

PRACTICAL LESSONS IN THE TREATMENT OF AFFECTIONS OF THE GASTRO-INTESTINAL TRACT BY ELECTRICAL METHODS.

By George Herschell, M.D., Lond.

(*Continued from page 149.*)

Treatment of Myasthenia Gastrica or Atonic Dilatation of the Stomach.

Muscular weakness of the stomach wall is one of the most important conditions which we have to treat, as not only is it a frequent and often unrecognised primary cause of dyspepsia and is often present as a complication in most affections of the stomach, but it is usually very rebellious to ordinary modes of treatment by means of diet, drugs and lavage. Fortunately such cases are almost certain to be relieved in any stage, and if not too far advanced, usually cured for all practical purposes by appropriate electrical treatment.

To secure these results we must confine our treatment to cases in which the trouble is due either to defective innervation of the muscular walls of the stomach, or to atony pure and simple of the muscular fibres themselves, and in which actual degeneration of muscular fibres has not taken place. We can also not expect to obtain any success if any obvious cause for the atony remains unrelieved. A correct anatomical and pathological diagnosis is therefore imperative that we may not waste precious time in fruitless efforts to cure by electricity an atony which is due to a chronic gastritis, or a mechanical stasis in the gastric veins the immediate result of portal obstruction, or to pyloric stenosis. I am sorry to say that in most of the cases of dilatation of the stomach treated by electricity which I have seen reported, a proper diagnosis was evidently not made. The operator apparently grasping the obvious fact that the patient had an enlarged stomach, did not trouble further to enquire into the factors which were present in its production, but at once proceeded to blindly subject the patient to electrical treatment. The results thus obtained are of course worthless from a scientific point of view.

Having selected a suitable case of atony of the stomach for treatment, the choice of methods will be largely influenced by the stage which the affection has reached. For clinical purposes we now divide gastric myasthenia into three degrees. In the first degree the stomach has simply lost its contractility and can empty itself of its contents before the next meal, but allows gas to accumulate often in considerable quantity. In the second degree the stomach is unable to empty itself before the next meal, that is to say in five or six

hours, but succeeds in doing so during the night. This stage is termed the "stagnation form," as the food has time to stagnate and ferment before it is finally expelled from the stomach. The third degree is termed the "retention form," because the stomach can never completely empty itself, but always contains fermenting food residues. It has been now practically agreed to apply the term "dilatation of the stomach" to the second and third degree only.

In the first stage we can nearly always cure the patient without passing an electrode into the stomach by using electricity percutaneously, but in the other two more severe degrees we can hardly ever do so, and must reconcile ourselves to the passage of an instrument. As regards the results we may expect, the first stage can be nearly always cured, and the second stage can practically always be relieved and often cured. The third stage can usually be benefited to the extent of being converted into the stagnation form when the patient can live a comfortable life as long as he pays attention to his diet and performs periodical lavage of the stomach. I think that it may be taken as a general rule that we may expect by means of electricity to convert myasthenia of any degree into the stage immediately preceding. That is to say, the first stage will be cured, the second stage will become the first, and the third the second under proper treatment.

Before commencing the electrical treatment of a case of atony of the stomach, it is absolutely essential that certain tests should be performed, and these should be repeated at intervals during the course of treatment. We shall thus know exactly the results which we are obtaining from our treatment, and shall not be obliged to rely upon the subjective sensations of our patient for evidence of improvement. In myasthenia of the first degree, as we wish to avoid the passage of the instrument into the stomach, we shall confine ourselves,

(*a*) To ascertaining the size of the stomach by percussion and palpation after the administration of an effervescing powder*.

(*b*) To noting the difference in the level of the lower border of the stomach before and after the ingestion of two tumblers of water, the patient being in the erect position.

(*c*) The performance of the salol test.

(*d*) To noting the time after a full meal at which the splashing sound can be obtained.

In myasthenia of the second and third degrees, in addition to the above, we must ascertain the amount of food residues present in the stomach six and 12 hours respectively after

* For this and the following tests *vide* the Author's "Manual of Intragastric Technique." London, 1903.

a meal, and note the behaviour of the stomach contents in a fermentation tube, both as regards the interval which elapses before gas is evolved and its relative amount.

Treatment of Myasthenia of the First Degree.—The following methods may be employed:—

1. *High Frequency.*—If this form of electricity is available it should certainly be used in preference to others, especially in the treatment of the slighter forms of myasthenia associated so often with neurasthenia. In addition to general treatment on the condensation couch, I usually employ one of the following local measures according to the indications present in each individual case. The application to the epigastrium of,

(*a*) A circular electrode of bare metal, three inches in diameter, weighing about a pound.

(*b*) A well moistened pad having a piece of animal membrane interposed between it and the skin of the patient. This I find to absolutely prevent the possibility of burning the skin.

(*c*) The effluve from a metallic brush suspended above the patient.

The patient for this application reclines on the condensation couch, the active electrode being attached to the top of the resonator or one end of the *bobine double d'Arsonval*, whilst the other end instead of being earthed in the usual manner is connected to the metal plate which forms the under part of the couch. If the current of high frequency is not available we can get the best results with the triphase sinusoidal, or in default of this with the constant galvanic current rhythmically interrupted.

2. *Triphase Sinusoidal Current.*—One electrode of about 16 square inches in area is placed upon the epigastrium and two narrow electrodes on the back, one on each side of the spine. Alternations as slow as can be arranged, current strength sufficient to produce efficient contractions of the abdominal muscles. Duration of treatment 10 to 15 minutes, daily for a fortnight, three times a week for another fortnight, and twice a week for a month after.

3. *Constant Galvanic Current.*—Whilst in most cases high frequency or the triphase current undoubtedly gives the best results, yet in some forms of the affection nothing can replace the constant galvanic current. This is notably the case when any trophic changes are present in the muscles. In these cases we must use the current in the manner presently to be described with slow reversals. In ordinary cases we commence the treatment by the stabile application of the current to the nape of the neck and epigastrium, and follow this up with an application

of the same current broken up by means of a mechanical rheotome interposed in the circuit. The rheotome or mechanical contact breaker is placed in the circuit between one of the battery terminals and the electrode connected with it. The rheotome which I habitually use is manufactured by the McIntosh Electrical Company of Chicago, and is shown in the accompanying illustration. It is constructed on the principle of the metronome and will break the current from eight to 600 times a minute.

We will assume that we have completed the application of the constant current with stabile electrodes and are about to administer the same current with slow interruptions. The patient is lying on the couch with the electrodes in position. Allow the abdominal electrode to remain in position, but shift the other one from the nape of the neck to the dorsal

McIntosh Clockwork Rheotome.

region. Place a towel under it to ensure that it is in absolute contact with the patient as he lies upon it. The first point to be decided is the appropriate dose. Set the rheotome to break the current 200 times a minute and slowly turn the handle of the rheostat. Stop as soon as contractions are produced in the abdominal muscles. It is not necessary to produce very strong contractions, it being a popular error to suppose that the larger dose you give the better results will be produced. Now experiment by increasing and reducing the current and the rapidity of interruptions, respectively, until the muscles are doing the most useful work of which they are capable. With a little practice it is easy to recognize the elastic full contraction of a muscle working well within its power, and no trouble or study should be grudged in this direction, as it is only when undergoing contractions of this character that the greatest nutritional effect is being produced. If the patient should complain of discomfort before this point is reached, pause until the sensory effects subside, which they will do in a few minutes. When this has occurred,

again increase the current strength, and thus proceeding, step by step, the appropriate dose will be reached with the minimum of distress. In cases where there is probably some degeneration of the muscles a different technique should be employed. You set the rheotome to beat slowly and reverse the direction of the current, by means of the current reverser switch on the battery, between each muscular contraction. About the best rapidity of the rheotome at which to do this, I find to be that which gives 30 contractions of the muscles per minute. This will allow plenty of time for the movement of the switch between each. These slow interruptions and reversals appear to exercise a powerful effect for good upon the nutrition of muscles.

If we do not possess a clockwork rheotome, but have a battery fitted with a modern rheostat, such as a Willm's current controller, or a Jewell carbon rheostat, we can produce by hand an imitation of a slow sinusoidal current, and by this means can obtain very good results. A good deal of labour is, however, involved and we are working in a very primitive manner, reminding one very much of the early days of the steam engine, when the valves were opened and shut by an attendant at each stroke of the piston. All we have to do is to proceed in the following manner. First of all apply the well wetted electrodes to the patient. Then gradually turn on the current until you reach the point when an efficient muscular contraction is produced by breaking the circuit. Now tie a piece of string to the handle of the rheostat and secure the other end to one of the terminals of the battery in such a manner that the rheostat handle cannot be moved beyond this point. Now, taking the rheostat handle in one hand and the reverser in the other, you slowly, smoothly, and without halts or intermissions, move the former backwards and forwards between this point and zero, reversing the current each time, at the moment when you reach zero. You will thus produce a regular increase and diminution of the current in the two opposite senses with reversals at zero, and imitate exactly a slow sinusoidal current. Applied in this manner, it is exceedingly grateful to the patient, but wearying to the operator. For this reason it is not to be recommended, except as a makeshift when other apparatus is not available. It is, moreover, a good example of what a capable and clever workman can do with inferior tools, and should encourage those of us who possess only the most elementary outfit to make ourselves thoroughly conversant with the potentialities of our apparatus.

Myasthenia of the Second and Third Degrees.—In the treatment of these it is waste of time to attempt the percutaneous application of electricity, and if the patient wishes to

be cured he must make up his mind to allow an intragastric electrode to be passed. Fortunately, owing to the improved electrodes of Einhorn and Boardman Reed, the process is not nearly so unpleasant as the passage of a tube, and the thin wire stem can be tolerated in the throat for quite a considerable time, without producing much discomfort. The technique of the passage and use of the intragastric electrode has already occupied our attention and need not be repeated here. For the treatment we may use : —

1. The constant galvanic current with slow interruptions in the manner just described. One pole, connected with the electrode, placed upon the epigastrium, and the other attached to the intragastric electrode.

2. The triphase sinusoidal current. One terminal attached to the intragastric electrode, one to an electrode upon the epigastric region, and one over the dorsal vertebræ.

3. The monophase sinusoidal current with a rheatome in the circuit.

4. The induction coil current. If we make use of this apparatus we must employ an instrument fitted with a slow contact breaker. If we throw a muscle into tetanic contraction by the application of any kind of electrical current, and keep it so for any length of time, we shall only exhaust it, and do harm instead of good. If we wish to strengthen it, we must allow periods of rest to elapse between the contractions. As Monell appositely remarks* "exhaustion and refreshing benefit are locked up in the balance between work and rest. If the period of rest is short, the intensity of work done must be low in proportion. If the intensity of work done is high, the period of rest must be long in proportion." In generating apparatus, consisting of rotary convertors, we can secure this period of rest by retarding the rapidity of phase, as we are able to keep the output constant by increasing the amount of current entering the machine. In motor generators, unless they be of unwieldy size, we cannot slow the revolutions without reducing the output to such an extent as to be useless for therapeutic purposes. In these cases we must use a mechanical rhèotome in the circuit. In the case of induction coil apparatus we most conveniently have a slow contact breaker fitted to the machine, and the practitioner in purchasing an induction coil set will do well to refuse as obsolete any not so fitted.

In any form of electricity the duration of intragastric treatment should not exceed three minutes at first, gradually increasing from day to day until ten or fifteen are finally given. Three times a week is quite often enough, and the best time

* "Elements of Correct Technique in Electrotherapeutics." Monell. New York, 1900. Page 90.

tor the treatment is an hour before the chief meal of the day, there having been a preliminary lavage in all cases where there is much retention of food residues.

As regards the use of high frequency currents in the treatment of myasthenia, whilst of the utmost value in cases of the first degree where there was no retention of food residues, my experience has shown me that if of any use at all in the severer cases to which alone the term "dilatation of the stomach" can legitimately be applied, which I doubt, they are very far inferior to the other forms which I have described. And I have not yet seen in print an account of a case of "dilatation" of the stomach successfully treated by currents of high frequency in which the diagnosis had been properly worked out, so that one could be sure that gastric insufficiency was really present. In the cases recorded the writers relied upon the apparent size of the stomach to percussion for their diagnosis of dilatation. Inflation had not been performed, and it had not been ascertained whether food residues were or were not present in the stomach. They might therefore obviously have been cases of myasthenia of the first degree, such as are often met with in neurasthenic conditions, without retention or stagnation, and we have no evidence that they were true dilatation. Such cases, as we all know, of simple slight loss of tonicity of the stomach walls can be readily cured by several electrical methods, of which, however, the resonator current appears to be the best.

(To be continued.)

X-RAY AND LIGHT RESEARCH.—At the last session of the Legislature of Pennsylvania there was appropriated to the University of Penna the sum of $25,000.00 for a laboratory for X-ray research and for Finsen light apparatus. This department will be connected with the University Hospital. The plan is to build a laboratory in connection with the Agnew pavilion. The department is to be under the direction of Dr. Henry K. Pancaast, assistant instructor in clinical surgery and assistant demonstrator in anatomy. The purpose is to establish a very complete Finsen light plant for the purpose of undertaking extensive experiments in this country by this method in the treatment of skin disease.—*Journal Am. Med. Asso.*

ON THE METHODS OF APPLICATION OF HIGH FREQUENCY CURRENTS.

By Clarence A. Wright, F.R.C.S. (Ed.), &c.

(Continued from p. 153.)

The Oudin Resonator and its modifications.—This is the apparatus most favoured for local applications. In simple monopolar applications the active capacity (*i.e.*, either the patient or the electrode, as the case may be) is either connected with the free upper terminal of the secondary solenoid of the resonator, or with one of its uppermost spirals, by means of a moveable contact slide. In the older types of resonators, in which the spring-catch adjustment was made use of, the maximum effect could not easily be obtained, and even when arrived at, the attempts to graduate the intensity often resulted in either a total suppression of the current or an equally undesirable alteration in its character. The introduction of the moveable contact slide was the first real attempt at graduation, but even then the drop in intensity was often too sudden and great to afford any degree of satisfaction. In the newer models, in which the contact piece either follows the convolution of the wires of the solenoid or has them pass before it in regular succession, this has been corrected, and a progressive, easy, and extensive graduation of effect can now be obtained. It may, however, be said that in employing the effluve from a many-pointed rose-electrode the best effects are obtained when the tension of the current is at its maximum, all variations that decrease its intensity increasing the liability to substitute sparks for it. The discharge from a resonator attains its maximum value when the inductor and induced circuit are in resonance and the lower terminal of the primary solenoid carried to earth. In making bipolar applications with an ordinary resonator it is usual, instead of passing the current from this terminal to earth, to use it as the pole at which the patient is placed in derivation. Of course, the effects obtained by this procedure are incomparably less marked than when a duplex resonator or two resonators, tuned for producing interpolar effects, are employed; as the zone of current density increases with the greater difference of potential between the two poles. For double effluvation two resonators are indispensable. They can be tuned by altering their method of wiring to produce homopolar or interpolar effects, the two primary solenoids are mounted in parallel, or in series.

The d'Arsonval Coil of High Tension.—In simple monopolar effluvation, both eductive and receptive, the active

capacity is attached to one of the terminals of the inner or secondary coil (in which the induced currents are generated); the other terminal either remains free or is connected to earth. In bipolar applications, the patient and electrode are attached, one to each extremity of the secondary coil, whilst the outer or inducing coil is placed midway between them. Double effluvation, when practised with a coil of high tension, can only be receptive, for homopolar effects are, from the very nature of the winding, totally impossible. When monopolar applications are made the alteration in the position of the inducing coil allows of a very fair graduation of effect; with the primary at the point closest to the earthed terminal, the discharge is all that can be desired; but the degree of regulation in bipolar applications is very far from satisfactory.

The miniature d'Arsonval coil of high tension, known as the "Condenser High Frequency Coil," consists of a coil of fine wire insulated by a viscid hydro-carbon and enclosed in a protective casing of ebonite or micanite. It is intended for introduction into the small solenoid of high frequency. It yields a poor effluve and allows of very little regulation.

Guilleminot's Spirals. — The active capacity is here attached to the central free extremity of the innermost spire. A single spiral being all that is required for monopolar applications, static effluvation and the cephalic douche; but, two spirals are needed for bipolar applications and double effluvation. In bipolar applications the patient is placed in monopolar derivation on the free central extremity of one spiral, while the effluve from the other is directed against the parts to be treated. To effect this, it is essential that the two spirals be wound to produce interpolar effects. In double effluvation the body of the patient, or the part to be treated, is introduced between the two spirals. This apparatus permits of a fair graduation of effect in bipolar applications, and double effluvation by altering the distance between the spirals. The limit of regulation in unipolar applications is also larger. As the inducing effects of a flat helix is greater than that of a cylindrical solenoid composed of the same number of wires, the effluve from a Spiral is greater than that from a resonator Oudin.

Reus' Cones.—This apparatus is the most perfect form in which a resonator can be constructed to produce a maximum effluve whilst allowing the widest graduation of effect. It combines the good points of the flat helix with the advantages, that winding to produce interpolar effects, offer. In unipolar effluvation, both eductive and receptive, the active capacity is attached to the free terminal of the Cone; whilst bipolar applications can be made even with a single cone. If, however, two cones be employed the effects are in-

comparably better than that obtained with either Spirals or resonators. With them double effluvation, both eductive and receptive, can be practised, with a maximum of effect and a minimum trouble in regulation. Reus' cones are, *par excellence*, the apparatus for all local applications, as the regulation for unipolar, bipolar, and double effluvation is by far the most perfect, and leaves nothing to be desired.

The Tesla Coil.—This apparatus yields a good discharge of effluve and sparks but allows of no direct control being exercised over its intensity. The active capacity in unipolar applications is attached to one of the secondary terminals, the other being earthed. In bipolar applications one terminal is connected with the body of the patient and the other with the electrode. Double effluvation with interpolar effects alone can be produced, as with the d'Arsonval coil and duplex resonator. The noise made by the apparatus whilst working and the absence of graduation have, to a great extent, limited its employment in local applications.

In all, except the first-named apparatus, the tension of the currents is raised either by induction or resonance; as the length and intensity of the effluve are by these means increased the limits of graduation becomes thereby proportionately extended.

REACTION.—In considering the physiological effects of local applications, it must be remembered that the effects incidental to static discharges are superadded to the more ordinary dynamical effects of the currents. In relation to the subject we have, therefore, to distinguish and separately consider the effects that this method of Vibratory Electrisation has upon (*a*) the contractile tissues; (*b*) the sensory nerves; and (*c*) the skin.

The Effects of Local Applications upon Contractile Tissues.—These are readily sub-divided into two distinct classes of phenomena, *i.e.*, the neuro-muscular and the vaso-motor, the last being best considered in relation to the effects of local application on the skin.

Neuro-muscular Phenomena.—When a conductor of small capacity, say a small olivary or probe-pointed wire electrode, is connected with the free upper terminal of a resonator or cone and approached to the surface of the skin, it is noticed that the passage of the discharge-currents gives rise to momentary idio-muscular contractions. This can equally well be demonstrated with the electrode applied over a motor point as with one more directly in relation with the muscles itself. The contractions so elicited are strictly local and momentary, being quite unlike those produced by faradisation; for the researches of Doumer and Oudin prove that they entirely dis-

appear when the oscillations of high frequency are established. Although the explanation of this seeming paradox must be deferred to a subsequent paper, it must be remembered that these effects upon contractile tissues are due to the static discharges and not to the dynamic properties of the currents; for if instead of a single pointed electrode, a multi-pointed rose effluver, a vacuum or condenser electrode of large surface capacity be used, this idio-muscular reaction is correspondingly diminished, as these, by distributive sub-division of the irritation engendered by the passage of a discharge-current, minimise, if they do not quite completely annul, it. A similar reaction can also be noticed when contractile structures of epithelial origin, as the erector papillæ of the skin, are submitted to the static discharges of high frequency. It must, nevertheless, be remembered that, however energetic the initial response of contractile tissues to the current discharge may be, the dynamical effects of the currents will eventually produce a myasthenia, if the session be sufficiently prolonged; although this effect is slower in appearing than when derivation methods are employed.

Effects upon the Sensory Nerves.—Perhaps the first impression* made on the sensory nerves of the body is one of local warmth in the part submitted to treatment. Various explanations of this phenomena have been put forward, the following being those suggested by Cæsare, Hance, Texeira and Reus :—

Alexis Cæsare looks upon it as a radiation of the heat engendered by the passage of the current through the substance of the electrode. He draws a delicate and overfine distinction between it and the burning sensation caused by the discharge of sparks, and claims that it is more noticeable when the electrode is in almost immediate contact with the skin, whilst it becomes less marked as the distance between them increases. In support of his contention, he instances the results observed when an anero-calorimeter is placed first in the interior of a large cage of auto-conduction and then inclosed in an ordinary resonator. The temperature recorded in the former case being lower than that observed in the latter. His views, however, are too hypothetical to deserve more than a passing mention, and the conclusions he draws from many of the experiments are by no means always borne out by the facts he details.

Hance regards it as a manifestation of the influence of the static discharge upon the vasomotor nervous system, and is inclined to attribute it to a surging of the blood to the part, by reason of the dilatation of the capillaries. This view has re-

*Alexis Cæsare declares the first sensation to be one of transient chill, coincident with the momentary vasomotor contraction of the capillaries of the part treated.

ceived very little support, for it is within the experience of the greater majority of operators that the sensation is noticeable before the primary vaso-contraction has passed off and even whilst it is well marked.

Texeira is of opinion that the sensation is purely subjective and to be referred to an excitation of the thermo-esthetic fibres of the sensory nerves by the static discharge. He uses the following analogy by way of an explanation: "The fibres of the optic nerve are primarily intended to convey to the sensorium the luminous impressions made upon the retina: yet a person who, in the dark, receives a sudden blow upon the eye, or in its neighbourhood, ofttimes perceives a purely subjective sensation of light." He views the dilatation of the capillaries that accompany the sensation "as a reflex, which finds its parallel in the contraction of the pupil that ensues whenever these purely subjective luminous sensations are perceived." This view is too problematic to be generally admitted.

The true explanation is probably that given by Reus, who says: "*The sensation of warmth is due to the heat generated in the skin by reason of its great resistance to the passage of the current.*" This explanation is in accord with the Joule effect manifested by conductors.

Whatever the cause of the condition may be, it can be remarked that the sensation of local warmth increases as the session proceeds and is accompanied by others more pronounced and disagreeable. These vary somewhat with the character of the discharge. When it is an effluve of moderate intensity a prickly sensation is also experienced. This is usually easily tolerated by the patient, and only passes into one of burning heat when treatment is prolonged beyond 15 minutes. With spark discharges, on the other hand, the feeling of local warmth is soon (*i.e.*, after 15 to 20 seconds) merged in the more decided sensation of ardent heat, that rapidly passes into pain, which in the end becomes unendurable. When a condenser, fluid, or vacuum electrode is used, the eucomides, being smaller and more delicate, cause less pain. Still, as the aftermath of treatment, even by the effluve, a sensation of local warmth is experienced. It usually comes on during the first 20 minutes after the termination of a session and lasts for some hours.

A more therapeutically important effect of effluvation is the analgesia or paræsthesia so successfully employed in the treatment of pruritus and obstinate neuralgias.

Anæsthesia.—This is usually regarded as an example of the inhibitory influence of vibratory electrisation upon the sensibility of the skin and tissues, but it appears to me to be a physiological concomitant of the static discharges rather than

a dynamical effect of the currents themselves. D'Arsonval was the first to call attention to the fact that anæsthesia could be produced by local applications, the passage of the discharge—*la pluie de feu*—giving rise to an insensibility more or less pronounced, according to the conditions of the experiment. This diminution in excitability to ordinary stimulation is more in evidence in the parts exposed to the direct action of the discharges—as the skin, mucos and peripheral ends of the sensory nerves—than in structures more deeply or distantly situated, although even these appear in some measure to be affected by the passage of the current. D'Arsonval claims that one can by this means produce a complete insensibility of the tissues to painful sensations, which lasts for 3 to 20 minutes and is available for minor surgical operations. This statement, however, has been very largely controverted. Denoyés declares that the anæsthesia does not extend to any very great depth. Freund says that this insensibility is very superficial and almost inconsiderable. Sudnik, on the other hand, believes that it extends more deeply, more especially as he has been able to turn it to account in facilitating the reduction of dislocations. Boudet, Regnier, and Didsbury have found it of service in dental operations. Oudin and Cruet, experimenting on the degree of anæsthesia necessary to render tooth extraction painless, found that an application of 4 to 5 minutes' duration was sufficient for the incisors and canines, whilst 5 to 8 minutes were required for bicuspeds and molars, which possess more than one fang. Doumer and Oudin state that the degree of local anæsthesia recommended by d'Arsonval for surgical operations is in reality only the first stage of cell mortification, being similar to that produced by freezing the tissues. Müller attributes the anæsthesia to the sedative action of the blue and violet rays upon the vasomotor filaments. Crooneg ascribes it to the ultra-violet radiations, the rapidity of whose rhythmic oscillations determine both its degree and depth. Bædeker, who has put the various statements of d'Arsonval to the test of practical experiment, says: "We have found in this respect (*i.e., aller jusqu'à l'anæsthesie complète*) that there is not the slightest trace of complete anæsthesia. The variations in sensibility—to some of which I shall presently allude—were for the most part present in a very minor degree. I found, by comparison with the corresponding point on the opposite side of the body, that there was in all the cases investigated a slight diminution in sensibility, immediately after a session of 5 minutes' duration, both for the sense of touch and pain. Dr. Cowl, Dr. Helkenberg, and myself were the subjects of the experiments in this case. A trial made 10 minutes later showed that there was considerable hyperæsthesia in the now erythematous patch, both to tactile and

painful stimulation (*i.e.*, pricking with the needle). The results noticed in nine other cases made under exactly similar conditions to determine the sensibility of the tissues to cold and warmth were the same. A slight decrease in the perception of cold was manifested immediately after the session, but a similar reduction in that of warmth could not with certainty be established. Ten minutes later there was well-marked hyperæsthesia both for cold and warmth present. The patients, for instance, could not now touch with the effluvated hand an iron bar, whose heat could easily be endured with the untreated one—I, personally, experienced the same—whilst of two equally cold iron bars, they mistook for the colder the one touched by the hand treated ; when corresponding points on both hands were brushed over with ether, more cold was experienced in the part effluvated."

I have also experimentally investigated the effects of local applications upon tissue sensibility. As the result of observations made on 42 patients I find that the degree of anæsthesia produced varies with (*a*) the duration of the session ; (*b*) the character of the discharge ; (*c*) the tension and density of the current ; (*d*) the method of electrification of the patient ; and (*e*) the resistance of the skin at the seat of application.

(A) *The Duration of the Sessions.*—In seven cases submitted to a discharge of eucomides for less than 2 minutes, insensibility of the superficial structures was noticed in a slight degree immediately after the termination of the session, but did not last for more than 2 minutes in two cases, for less than 1 minute in three cases, and for little more than 4 minutes in the remaining two cases. In seven other cases in which the session was prolonged for 3 to 5 minutes, with a similar discharge — eucomides — the anæsthesia was more profound, not only for irritants applied to the surface, but also to pricking with the needle. In none of these was its duration less than 1 minute for stimulation with the needle or less than 3 minutes for surface irritation with formalin applications and capsicum ointments. In five other cases, where treatment by sparks was endured for 5 to 8 minutes, the perception of pain for needle stimulation returned in less than 2 minutes in two cases, while in the remaining three it lasted for 3, 5, and 7 minutes respectively. The perception of surface irritation was much longer delayed in these cases than in those treated to shorter sessions. In three cases the skin continued insensitive for 10 to 12 minutes, whilst of the other two one did not perceive any irritation till 14 minutes had elapsed—this was one of the cases in which the duration of insensibility to

needling was less than 2 minutes—while in the other surface anæsthesia continued pronounced for more than 20 minutes. Among ten cases treated by the effluve for shorter periods than 2 minutes no surface anæsthesia could be perceived in four cases; in two others it was present immediately after the session but did not last more than 1 minute; in three others for 2 to 3 minutes, and in the remaining case it continued for 3½ minutes. In seven cases where the duration of the applications extended from 3 to 5 minutes, sensation appeared to be somewhat more annulled than in those previously considered both for surface irritation and needle stimulation. In all these some degree of anæsthesia could be established. It had increased in depth of penetration as well as in degree, so that the needle could in some cases be thrust to double the depth before any painful sensation was produced. The action of strong irritants was perceived in two cases in 1 to 2 minutes, and in the remaining three cases in from 2 to 4 minutes. Weaker irritant applications were tried on two patients similarly treated and perceived by them after 8 and 14 minutes respectively. The sensation of pain to needle stimulation returned in two cases 2 minutes after the termination of the session, in four cases after 3 to 5 minutes, and in the remaining patient after 8½ minutes had elapsed. In patients treated to a sitting of 5 to 10 minutes, a similar increase was noticed both as regards the depth and degree of anæsthesia, but in no case did it extend deeper than seven millimetres. In cases treated by sessions of 15 minutes, anæsthesia to surface irritation lasted for more than 18 minutes, whilst for deeper stimulation (needling) a similar increase was noticed. From these observations we are led to believe that the duration of the session has an important bearing upon the degree of anæsthesia produced.

(*To be continued.*)

BLUE LIGHT AND TUBERCULOSIS.—Freudenthal, in discussing tuberculosis, emphasizes (1) Diagnosis.—(*a*) A positive diagnosis of pulmonary tuberculosis when physical signs of trouble in the lungs are still lacking, can be made from the condition of the upper air passages; (*b*) injections of the old tuberculin of Koch will often clear up an obscure diagnosis. (2) Treatment.—The blue light treatment in connection with CO_2 administered by the rectum has, in a number of cases treated during the past year, given good results.—*Medical Record*, March 19th, 1904.

1904.

By Dr. W. S. Hedley.

(Concluded from p. 158.)

The second instrument measures the *quantity* of rays. It is all important in connection with X-ray burns, to know the quantity of rays actually absorbed by the skin. The principle is that certain salts assume a bluish-green colour in proportion to the quantity of X-rays absorbed. The colour is appreciated by a standard scale, and depends essentially on the *quantity* of rays absorbed, not at all on quality. The small case containing the salts is placed close to the region under treatment, until it has acquired the colour which experience has shown to be necessary for the case in hand.

A third method, which has lately been brought to my notice, consists in measuring the vacuum of the tube (and therefore the penetration of the rays) by measuring the current going through it. The vacuum is in inverse ratio to the quantity of current as expressed in milliampères. I need not go into the theory of this. But if the milliampère-meter be read with first a hard tube and then a soft tube in action, it will be found that this is the case.

Electro-therapeutics.

In electro-therapeutics there has been much active work in electro-diagnosis and in the study of electrical phenomena connected therewith. In the application of phoretic medication and ionisation, in the employment of continuous currents of high intensity and in polyphase current there has been a good deal of experimental work, but nothing, I think, in any sense epoch-making. The chief interest has centred in high frequency. Here there may be noticed a tendency to desert the methods of auto-conduction and the condensation couch for the newer method of bipolar effluvation. This is, as we know, carried out by attaching the patient by an electrode to the upper spiral of one resonator whilst the effluving brush, attached to the top spiral of the other, is moved about at a little distance from the body of the patient. There are other methods of doing this by using each end of a double resonator.

The condensing couch and auto-conduction which the earlier enthusiast thought was going to cure diabetes, albuminuria, and obesity, it is needless to say, has not come up to early promise. Nothing, however, has occurred to shake our faith in monopolar effluvation in some skin affections, hæmorrhoids, and anal fissure, and in the general and local treatment of some gastric and intestinal conditions. Comparisons have been instituted between the relative efficacy of high frequency and Finsen light in the treatment of lupus.

We know that the discharge furnished by high frequency currents is a source of chemical rays, and that the vaso-constriction caused by sparks is useful in aiding the penetration of these rays, but in my opinion there is not yet any sufficient evidence that such discharges can hold their own with Finsen light in the treatment of lupus.

There has been some controversy and much justifiable scepticism as to the effects of highfrequency currents in lung troubles. I do not know that we are much further forward on this point, but there is some strong testimony forthcoming as to their efficacy in diseases of the trachea and bronchi. I am indebted to Dr. Wright for the following extracts from a recent publication of Reus.

Chronic Bronchitis.—High frequency currents, applied in the form of the effluve, effectually subdue the cough and promote the oxygenation of the blood and tissue metabolism at the same time as they increase elimination. They not only promote general nutrition, but effectually combat the atonic dilatation, which favours a recrudescence of acute catarrh on the least exposure.

Chronic Tracheo-Bronchitis.—In the milder form of this affection, Reus confines electrical treatment to local condensation; reserving the effluve for cases in which moist sounds are audible or the cough very troublesome.

Electrical treatment, by promoting oxydation and removal of waste products, soon exerts a beneficial effect upon the progress of the case. There is usually a general as well as a local symptomatic improvement. Susceptibility to contract colds on the least exposure decreases as treatment proceeds.

The two following cases of Reus' clearly illustrate the relation of the disease to nutritive aberrations, and the technique to be adopted—

Case 1.—A short, thick-set man, who had been subject to gout for ten years, and who, five years previous to his first visit, had had an attack of bronchitis from which he slowly recovered.

Electrical treatment consisted of applications of the current by the splint-jacket condenser, were administered daily during the first three weeks, and then on alternate days for a further four weeks, after which he was perfectly cured.

Case 2.—A cabinet maker, aged 51 years, suffering from what he called rheumatic gout, and also subject to transient attacks of bronchial catarrh and shortness of breath on exertion and habitual cough.

Electrical treatment commenced with a session of condensation lasting five minutes, followed by effluvation of the base of left lung and enlarged joints. The duration of the sessions of condensation was gradually extended to 15 minutes

daily, with applications of the effluve for a further period of ten minutes. After 24 sessions the patient was discharged free from all respiratory trouble; he could also eat, sleep and digest well.

Dry Catarrh of Lænnec.—The derivation methods—which seem to be the most advantageous in treating this affection—first produce a general improvement in the condition of the patient and an increase in the powers of assimilation and digestion. A diminution in the frequency of cough and of asthmatical orthopnea is next noticed, but it is long after the symptomatic cure is complete that the excess of resonance, due to over-distension of the air-sacs, returns to normal.

In the case of a patient, aged 38 years, suffering from dry catarrh of several years' standing, a symptomatic cure was obtained after four months of treatment, but it was only at the end of nine months that normal thoracic resonance was established. In this case, the patient was placed in derivation upon one pole of the small solenoid, while a roller-brush electrode attached to the other pole was moved over the thorax both anteriorly and posteriorly until a marked revulsive effect was produced. (Reus.)

Pituitous Catarrh.—In this affection, Reus favours local condensation followed by effluvation. In this way, he says, the circulation and nutrition of the bronchial tubes can be improved, and the elasticity of the lungs greatly increased.

The stimulating and tonic effects of condensation, coupled with the sedative action of the effluve on spasmodic dyspnœa, quickly modify the progress of the more urgent symptoms; but time is required to re-establish the general health. Reus records a case treated to auto-conduction combined with effluvation. The patient was discharged at the end of three months of treatment, free from all bronchial symptoms, although resonance on percussion was still above the normal.

Bronchiectasis.—The therapeutical indications furnished by a study of the disease point to the necessity for combined general and local treatment: this requirement being met by local condensation with effluvation, the local applications being made to the areas in which dilatation of the walls is plainly evident.

Improvement in the general condition of the patient in a great measure precedes that of the local lesion, which, on account of the destruction wrought by the disease, responds more slowly to electrical treatment.

Not the least among the advantages that accrue from electrical treatment is the diminished predispositon to catarrhal affections, which patients suffering from bronchiectasis are always liable to.

In two cases of Reus', a cure was effected after 54 sessions and in five weeks respectively.

Bronchial Asthma.—The predominance of spasm as a local manifestation of this disease suggests the utility of derivation methods in its treatment. Local applications of the effluve are of service in cases of asthma caused by nasal obstruction, when the seat of irritation can be traced. Less must be hoped for in the way of combating an acute attack than in counteracting the habit of disease; as it is only when the systemic effects of the currents are actively manifest that a decided improvement in local symptoms can be expected.

Crooneg reports a case which he submitted to derivation treatment. Applications by this means were made daily to the anterior aspect of the chest and epigastrium, and to the back between the shoulder-blades. After a period of two months (54 applications), the general condition of the patient was much improved.

A survey of these high frequency currents would be inexcusably incomplete without a reference to the danger, too often overlooked, of their unskilful or indiscriminate employment. It must not be imagined that "if they can do no good they can do no harm." In these days of "Institutes" and invasion of medical practice by laymen it becomes more than ever necessary to insist on this point. Certain experiments of Bordier and Lecompte during the past year put the matter beyond doubt. A rabbit attached by metal collars was put in circuit of the small solenoid (seven spirals of the latter being included) with a man and a galvanometer; the current was switched on showing a strength of 300 milliampères. At the end of three minutes the current was stopped and whilst the man felt absolutely nothing, the rabbit was quite overcome and was found to be suffering from paraplegia of the hind-quarters. Fourteen days after this it died. Another experiment made on a guinea-pig using buccal and rectal electrode, an arrangement which of course intensified the current bringing it up to 500 milliampères or more, it was found that after one minute the spinal muscles were contracted and those of the neck became rigid, and at the end of seven minutes both respiratory and cardiac movements ceased and the animal died. A rat under similar conditions died in 25 seconds. It is evident therefore that although the human subject does not feel these currents, still the inference is obvious that they must have potentialities for mischief even in man.

LECTURES TO MEDICAL PRACTITIONERS ON PHYSICS APPLIED TO MEDICINE.

By Sir Oliver Lodge.

SUMMARY OF LECTURE III.

SURGICAL AND MEDICAL APPLICATIONS OF RAYS.

(Continued from p. 162.)

Surgical Uses.—The surgical uses of X-rays are the study of fractures and abnormalities, the exact localisation of foreign bodies such as needles and bullets, and the detection of calculi. For localisation Mr. McKenzie Davidson's portable cross-thread localiser is quite the best plan. It is always worked in conjunction with photography, and with cross lines of reference thrown on to the plate: two pictures being necessarily taken from two different radiant points in known positions relative to the cross; though it is possible to take them both on the same plate, or even simultaneously with two bulbs placed in known positions, or with one bulb containing two anodes, though I do not know if this has ever been suggested or done.

A simple calculation from the resulting photograph, or manipulation of the cross-thread apparatus, then gives the exact position of the object inside the body or limb: so far from one line, so far from the other, and so far in; along a perpendicular at a point marked on the skin of the patient. It is necessary to be cautious and be sure that the right *quadrant* is marked: an error in aspect of plate would be serious. Localisation ought to be decidedly useful for subsequent operation, but the surgeon is apt to come on the bullet rather sooner than he expects, because localisation gives the centre and he feels the circumference.

For preliminary inspection, and sometimes for aid during the subsequent operation, a fluorescent screen is extremely serviceable, the bulb being below the patient. The screen is then used in the ordinary dark box manner, with double eyeholes, and it can be applied as a guide during simple limb operations; but for medical and more difficult trunk inspection a dark tent or sentry box, with one "window" as it were composed of fluorescent screen, arranged in the X-ray laboratory, is by far the best plan; since it enables the "inspector" or consultant to keep his eyes in the dark while the X-ray operator and patient remain in the light. This is McKenzie Davidson's plan, and consultants appreciate its convenience, though a complete understanding of what is seen is an affair of training, and some prefer photographs.

For anatomical use and interpretation, the pictures produced by the X-rays are remarkably complicated—more complicated than any other kind of picture can possibly be, because pictures are generally limited to one stratum or surface at a time, and where things are behind each other the hidden parts are invisible. But with X-ray pictures nothing is entirely invisible; all the whole complex is shown, with the parts superposed on each other on one flat surface, and all semi-transparent. Consequently such delineations require great skill to read, and it is almost impossible to decipher them fully without stereoscopic aid. But by the device of taking two pictures, with the X-ray bulb in different positions, on two separate plates, and then placing results in a Wheatstone reflecting stereoscope (or, if they are small enough, in an ordinary Brewster lenticular stereoscope), the most surprising effects can be produced, and the anatomical structure of the body can be seen as it has never been seen before: the whole organisation standing out in space as a transparent solid. Such a view is of great help in localisation of difficult things like calculi, and for lung and other diagnosis; while for anatomical purposes the vessels can be injected with either lead or mercury and be made to stand out prominently too. No way has yet been devised for rendering visible the nervous system.

The great advantage of subsequent stereoscopic examination renders it desirable always to take two pictures on two distinct plates, one from each of two neighbouring radiant points. It is usually better to take them thus than to take two views in directions at right angles to each other: though that too is sometimes done.

Medical Uses.—The chief medical uses of rays at present seem to be for skin diseases, lupus, rodent ulcer, and the like. It would appear, from statements so far made, as if ultra-violet light treatment were best for lupus, and X-ray or radium treatment for rodent ulcer; but such statements must be made and judged by physicians, not by me.

For superficial or skin treatment, soft tubes are more active than hard tubes, since penetrating rays are clearly unnecessary. To limit the rays to the desired area, special forms of tube can be employed, and also a close-fitting screen or mask with one aperture is usually applied to the patient so that only the intended area is exposed.

A study of the deleterious or inflammatory or burning action which accompanies the rays is most important. I believe it to be a secondary effect, and to be chiefly due either to ultra-violet light, which is often a secondary or partial concomitant even when not directly aimed at, or to the chemical or ionising action of the rays upon the tissues or upon air in immediate contact with the exposed surface.

Ultra-violet rays are certainly blistering to the skin, and are distinctly bactericidal; hence when applied they should be carefully localised. But many electric actions, sparks and the like, give off ultra-violet rays as a secondary effect: hence precautions are necessary in all these cases. Fortunately it is easy to stop ultra-violet rays without stopping others, since they have no penetrating power; a sheet of black paper or any light covering is sufficient to stop them.

The chemical or ionising action of the rays, the same sort of action as enables them to cause an electroscope to leak, results in the production of ozone and of oxides of nitrogen: briefly they have an oxidising action. This will naturally be limited to the surface where the oxygen of the air exists and is not to be expected in deeper parts. A curious observation has been made that when X-rays are sent for some time through, say an arm, a burn appears both where they enter and where they leave the arm, with no apparent action between. Also it has been stated, by one observer (*Archives of Röntgen Ray* for June, 1902, page 7), that of a patch of lupus extending round the arm, the portion which most benefited by treatment was on the further side, while the near side was acted on too violently and as if by two opposing causes. The near side would have been exposed to ultra-violet light and to the electrostatic effect of the tube; the far side would experience more nearly the X-rays alone. [I do not vouch for any medical statements; I merely quote them in order to direct attention to possible lines of investigation.]

The electrostatic action above spoken of may be described as a tendency to discharge electrons or negative electricity from all surfaces directly exposed to the bulb. It is easy, however, to arrange that the patient's skin shall not be the surface immediately exposed; a cambric handkerchief, and still more a piece of aluminium foil, for instance, would offer very little obstruction to X-rays, and yet would act as the discharging surface, completely protecting the skin from direct electrostatic action. Either because I always used a covering of some kind, or for some other reason, I was never troubled with X-ray burns on patients during my experience of long exposures.

As to the chemically active substances produced in the air by the rays, ordinary ventilation can do something to remove them as fast as they are formed, but whether it is possible that occasional cases of inflammation can be due to mere cold, my audience will know.

There remains the beta or cathode rays, which may be deleterious, and from radium probably are, though I have no reason to suppose them to be any notable accompaniment of X-rays from an ordinary bulb. They can be deflected aside by a magnet; and it is much to be desired that a long expo-

sure be given with all these extraneous rays eliminated or screened or deflected aside so that a study may be made of the effect of X-rays pure and simple.

To recapitulate.—The rays which are most easily stopped by the slightest obstruction are ultra-violet rays and alpha-rays: these can be eliminated by a thin covering of opaque screen. The rays which cannot be stopped are beta-rays and gamma-rays, otherwise called cathode rays and X-rays. But these can be sifted from each other by a magnet, which has no effect on the X-rays and which can powerfully deflect beta-rays (only the magnet must not be so strong or so near the bulb as to deflect the bombarding beam from its target).

The residual or secondary effects, other than mere cold, are the chemical or oxidising effects, some of which might perhaps be avoided by an atmosphere of hydrogen or simply by the use of a hydrocarbon such as vaseline, or by a tightly-fitting covering; and the electrostatic or electric discharging action, which can be displaced from the skin of the patient to any superficial covering which takes its place, or by an earthed metallic screen such as tinfoil or preferably thin sheet aluminium. By much less than all these precautions dermatitis can be avoided, but a complete study of the matter would involve the use of one or more of them successively. It would be very interesting to know if X-ray burns could be produced in an atmosphere such that no ozone or nitric fumes could be produced.

ULTRA-VIOLET LIGHT, as advocated by Finsen and stated to be specially successful for lupus, can be supplied by the arc lamp, with the light passed only through quartz and water—never through glass, for glass cuts most of them off, no matter whether it be coloured or quite plain. It can also be supplied by an ordinary electric spark, which though deficient in luminosity is often very rich in ultra-violet rays, especially if metallic terminals, such as zinc, copper, or iron, are employed. Iron seems to be best, probably because it lasts longer than zinc; otherwise a piece of zinc introduced into an arc gives a fine temporary emission of ultra violet rays. To give ultra-violet rays an arc should always be *long;* the source is the air *between* the carbons, whereas the positive carbon is the chief source of visible light.

Every lens and every window through which the rays pass must be of quartz, and they are so easily stopped that even too great a distance of air kills many of them. The thinnest pall of invisible smoke cuts them all off from towns, and with them their healthy bronzing and bactericidal influence. Water, however, is moderately transparent; so, it is to be supposed, is the outer skin of white people: hence their blisters on a mountain, and their bronzing on the sea or wherever air is pure. The pigment cells of tropical natives

are probably protective. The action of the ultra-violet rays is superficial, and hence it used to be the practice, and probably still is, to press down the tissues to be acted on, with a water-filled quartz lens so as to bring the rays into more immediate active contact with the skin and vessels from which the blood has been squeezed away.

Radium.—No such action is necessary with either X or radium rays, and the extreme simplicity of the application of radium seems likely to cause it to replace, for medical purposes hereafter when it becomes more plentiful, almost every other source of radiation ; except perhaps the various kinds of ultra-violet light.

Suggestion.—All that has been said about the admixture of radiation, and the precautions that must be taken to avoid sores, apply forcibly to the use of radium, and it would appear as if its action were not so clearly limited to the superficial tissues as some of the other agencies spoken of. At the same time, in so far as the beneficial action on, say, rodent ulcer depends to any appreciable extent on the oxidising power of air ionised or rendered active or ozonised by the rays, it is not to be expected that the same benefit will be felt in deep-seated cancers where the supply of free oxygen is non-existent. It is conceivable, however, that means my be found—at any rate, I venture to throw out the suggestion—for introducing into the tissues some form of tractable oxygen, or decomposing oxygen-compound, and then rendering it active by treatment with the more penetrating rays: being careful to protect the surface by all the means which already have been described. One advantage of radium plainly is that it can be applied in fine glass tubes to deep lying parts. The tube will stop the too violent alpha-rays ; there are no ultra-violet rays ; and there remain only the beta and gamma-rays, which are virtually cathode and X-rays in all probability. How these act is not yet proved, but if their destructive action depends at all on the existence of free oxygen, as seems not unlikely, it will be necessary to introduce into the tissues peroxide of hydrogen, or some other drug, if the rays are to destroy malignant growths. Otherwise they might even act in the opposite direction. For whereas ultra-violet rays have a burning and destructive effect on surface tissue, and can also kill bacteria, X-rays appear to have a stimulating and enlivening effect on healthy tissue, enabling it to replace itself more quickly than it otherwise could ; moreover, they are said to cause seeds to germinate more quickly, and generally to increase biologic activity. Hence there is a fear lest X-rays alone may actually stimulate the growth of those diseased cells which it is our object to curb.

It is not easy to suggest the best sort of injection to try for the purpose of co-operating with X-rays in deep-seated

cases; the oxygen is wanted in some available and unstable form. Arterialised blood is one substance which contains it in that form, especially under diminished pressure, when it can actually froth with oxygen; and why may I not venture to suggest that by injection of highly arterialised blood under certain conditions, or perhaps by the injection of actual gaseous oxygen with suitable precautions, simultaneously with the application of X or of radium rays, it may be possible to reach and gradually destroy even deep-seated malignant growths, provided it is possible to localise the injected material and keep it from the surrounding healthy tissue where the building up or stimulating power of the rays should be at work.

Whether the curious superficial action of the rays is really due to the presence of oxygen or not, it is most important to ascertain exactly what it is due to; because then there may be every expectation that the same conditions can be artificially set up in the deeper tissues where at present the rays have no apparent action. This cannot be because the rays do not reach those tissues; for they do: it must apparently be owing to lack of the assistance of some secondary concomitant which exists at the surface; and of which we have to find out the nature, and towards which one suggestion has now been made, for what it is worth.

APPENDIX.

None of the medical or biologic statements here quoted are quoted as authoritative or as coming within the lecturer's first-hand knowledge. They are referred to as suggesting channels of inquiry, and as worthy of consideration and investigation by those possessed of suitable opportunity.

There is a most interesting though possibly non-authoritative paper by R. N. Wolfenden, M.D., Cantab., and W. F. Forbes-Ross, M.D., Edinburgh, appearing in *Archives of the Röntgen Ray*, August, 1900, page 5, on "The Effects produced in Cultures of Micro-organisms and Tubercle Bacilli by exposure to the influence of an X-ray tube," which may be briefly summarised as follows:—

The difference in growth between culture tubes not exposed to X-rays and control tubes not exposed was very great, the X-ray tube having stimulated the cultures of *bacillus prodigiosus* (and apparently of tubercle bacilli also) to exuberant growth. The bacilli formed chains and spores. X-rays have been said to kill bacilli, but the authors find them strongly stimulative to vegetable life. Cress-seed exposed to an X-ray tube for an hour and then sown in a box, starts germinating sooner and shows a vigorous growth before non-rayed seed has commenced.

Maldini and Thouvenin also find that X-rays hasten the germination of seeds. Of two flasks of Pasteur's fluid, one sown with X-rayed yeast, and the other with ordinary yeast, fermentation begins sooner, and is much more vigorous, in the X-rayed sample.

Pure milk, X-rayed for an hour, quickly shows a greater degree of acidification (activity of *bacillus lactis*) than a corresponding sample not X-rayed. In some cases the culture-tubes were covered with earthed tinfoil, but still the effect was produced on the growth of cultures.

The authors' experiments absolutely negative any bactericidal action of X-rays,—quite different from electric light or sunlight.

The twelfth generation of stimulated culture may become exhausted from excessive proliferation, but rest enables them to recover.

In *Archives*, January, 1901, pages 43 and 48, the obvious suggestion is made that although X-rays may not kill bacilli they may stimulate the opposition phagocytes to greater activity.

In *Archives*, June, 1902, it is asserted, on page 6, that "the property that specially distinguishes high tension electric currents is their power of revitalising normal tissue that has been depressed by disease. Chronic ulcers can be healed by treatment with high tension currents ; you can almost see the cells growing"—quite different to ultra-violet light.

Extraordinary but most interesting statements, here abstracted only, appear in the *British Medical Journal* for 13th February, 1904, page 383:—

The nervous system is much more sensitive to radium than is the epidermis.

Animals, *e.g.*, mice, exposed to radium are killed by tetanic convulsions or by paralysis, or by increased excitability ; also the hairs are loosened.

Spermatozoa are rapidly enfeebled and killed by these rays, while ova may be fertilised. Ova exposed to radium rays may develop irregular embryos by parthenogenesis. The rays seem to act chiefly on cells which are in a state of evolution and differentiation, such as the skin, not muscle.

There seems to be a primary cell degeneration followed by secondary inflammatory reaction.

In *Archives of the Röntgen Ray*, No. 43, February, 1904, occurs the following convenient summary :—

The three physiological effects of radium are :—

1. Effects on the skin, producing inflammations and ulcers.

2. Effects on the nervous system, producing paralysis and death.

3. Luminous effects produced in the partially blind.

DIGEST OF AMERICAN LITERATURE.

RADIANT ENERGY.

RADIUM.—Van Beuren and Zuisser in *Some Experiments with Radium on Bacteria*, report a series of six experiments made upon various bacterial cultures, to determine the bactericidal action of radium. Twelve milligrammes of radium, with an estimated radio-activity of 300,000, in a sealed glass tube, was used (1) on virulent 24-hour bouillon culture of *B. typhosus*, distance of radium tube 1 cm. glass of radium tube intervening, exposure 10¼ hours at room temperature: result, negative after 48 hours, no inhibitory action being noted; (2) on a similar culture for 14 hours at room temperature, radium tube and culture tube fastened together by a rubber band and placed in a light light-receptacle, the thicknesses of glass intervening, 12 walls of radium and culture tubes: result, negative. A "hanging drop" preparation showed no inhibition of the mobility of the exposed bacilli; (3) a bouillon culture of an unidentified *saprophyte*, radium 5 cm. distant, one thickness of glass intervening, exposure eight hours at room temperature: result, negative, vigorous growth in 48 hours; (4) a control gelatine plate culture, freshly planted of *B. pyocyaneus* was exposed for 19 hours at room temperature: result, doubtful. 24 hours later the general growth in the exposed plate appeared to be less luxuriant than the control, and the area corresponding to the portion directly over the radium tube was less crowded than the surrounding medium. In this experiment the radium seemed to have a distinct though limited inhibitory action upon the vital activities of the exposed organism; (5) a control gelatine plate culture, freshly planted of *staphylococcus pyogenes aureus* was exposed for eight hours at room temperature: result, negative; (6) in order to test the action of the radium upon normal human tissues, the containing tube was bound upon the extensor surface of the forearm, one thickness of a linen handkerchief intervening, for 1½ hours: result, negative. Within four weeks after the exposure no perceptible change had taken place in the exposed tissues. This the authors regarded as noteworthy, in view of the fact that Becquerel is reported to have observed a burn within 10 days after six hours' exposure to radium of about 20,000. The authors conclude that the failure of their experiments to adduce positive evidence of any bactericidal or tissue-altering properties of radium may have been due to the interposition of glass between the active substance and the matter to be acted upon, or to the interference of light, or, more probably, to the shortness of the exposures. Pfeiffer and Friedberger made their exposures from 24 to 72 hours in length and in a dark chamber. From their observations the authors do not think that radium in the amount and of the radio-activity at present attainable, gives promise of such brilliant bactericidal and therapeutic results as prophesied for it by the enthusiastic paragraphers of the public prints. —*American Medicine*, December 26th, 1903.

X-RAY SHIELDS.

A really simple and effective device for confining the therapeutic action of X-rays to the area for which they are intended has proved "a long-felt want," and by no means so easy to accomplish as might at first sight appear. We have pleasure therefore in referring to two such instruments, and will be glad to be favoured with description of others. The first, the "London Hospital" X-ray shield, which it is understood is the outcome of an extensive series of observations, carried out by the radiographic staff of that hospital, is constructed of glass of special quality and composition, so as to arrest the rays, and has adjustable nozzles of various sizes.

It is adaptable to nearly all X-ray tubes, and has the further great advantage that the condition of the tube can be watched during the operation. It is made by Mr. Dean, of Hatton Garden.

The illustration shows a shield of stout red glass, which can be attached to any focus tube, the bulb of which has a diameter of 46 inches. Three funnels or nozzles of lead glass are supplied with the shield, and can be attached to it. The openings of the funnels measure 1, ¾, and ½, but other sizes are procurable. (Schall, 35, Great Marylebone Street.)

It thus appears that the two devices above described and figured claim similar advantages, viz. (*a*) the power to arrest the rays; (*b*) to be sterilisable; (*c*) to be adjustable to nearly every tube; (*d*) to permit of the tube being watched during the operation.

PART II.

PROCEEDINGS OF THE BRITISH ELECTROTHERAPEUTIC SOCIETY.

Edited by CHISHOLM WILLIAMS, F.R.C.S., Ed.

APRIL 22nd, 1904.

The Twenty-first Ordinary Meeting was held at 11, Chandos Street, Cavendish Square, W. The President, Dr. LEWIS JONES, occupied the Chair.

Present:—22 members and two visitors.

The following were duly elected:—Geo. Harrison Orton, M.B., 7, Campden Hill Road, W.; Richard Lane Joynt, M.D., 84, Harcourt Street, Dublin; Walter James Clarke, M.R.C.S., Gravelly Hill, near Birmingham.

Guilleminot's Spiral High Frequency Resonator was exhibited. (Isenthal & Co.)

One of the features of this form of high frequency apparatus is its extreme electrical flexibility, its great range of variation, and the powerful effects which may be obtained. It may be used in vertical or horizontal position, and is equally suitable for treatment with the effluve or for the couch or for biterminal application. One or two brushes may be obtained, and two spirals may be combined so as to give intense electric fields between them.

Dr. SOMERVILLE (Glasgow) then read his paper on "The Durability of the Therapeutic Effects of High Frequency Currents."

Mr. President and Gentlemen,—It is only within recent years that electric currents of high frequency have been employed by physicians in this country in the treatment of diseased conditions of the human body, but it will be allowed by all who can speak from practical experience that in these currents we have at our command a most valuable and efficient therapeutic agent. As time progresses it is found that a greater variety of cases comes within the scope of this method, and that by appropriate mechanical modifications the range and success of the treatment are surely extending. Experience is also showing that the benefits produced by the high frequency currents can claim, at least in most instances, the guarantee of permanence.

My purpose to-night is chiefly to relate some few instances from my own practice which illustrate this persisting value of the therapeutic influence following high frequency treatment.

In the first place I will quote some of my experiences in dealing with patients suffering from sciatic pain. In such cases it is necessary to satisfy oneself that the pain is a simple

neuralgia of the sciatic nerve and does not depend upon adhesions, the result of a perineuritis. The latter instances demand operation, for the purpose of separating the adhesions which, by dragging on the nerve, cause pain. Simple neuralgias, on the other hand, are readily amenable to high frequency treatment, and in my experience the cure is almost invariably a permanent one.

My first case was that of a farmer weighing about 17 stone, who had suffered from sciatica of the right lower limb for six months. The pain was present not only when he moved, but even while he lay at rest. Here I felt I had to deal with a case of pure neuralgia of the nerve, unaccompanied by adhesions. He required only eight applications to cure him of his pain. I could then place him in all positions capable of putting the nerve on the stretch, without any discomfort to himself. The patient was treated by me in September, 1902. I have seen him occasionally since, when he confidently affirmed that he was suffering no pain. My last interview with him occurred last month, 18 months after treatment, when I was happy to find that the pain had never returned, though in his work as a farmer he had been exposed to all kinds of weather. His own belief in the benefit he derived took a very practical turn, for he was the means of sending me several patients from his village.

One of these was a mason 50 years of age, who informed me that he had been subject to frequent attacks of pain in the lumbar region, due as he supposed to a twist, or "rack" as we call it in Scotland, while lifting stones. This statement was corroborated by his own doctor. The patient presented himself for treatment in November, 1903, and received five applications, which relieved him of all pain. He was last seen by me a month ago, four months after he had been treated, when he told me in grateful terms that he had had no return of pain.

Another case of sciatica accompanied by lumbar pains and stiffness at the knee joints, was that of a lady weighing over 13 stone, who was treated by me in June, 1903. After a short course the pain over the sciatic nerve and gluteal region disappeared. The knees became much less painful, and she was able to go up and down stairs and rise from her chair without any pain, and to play golf in the autumn. I heard of her a few weeks ago, and was gratified to learn that the benefit derived, nine months previously, still remained.

A third case I may refer to was that of a lady about 36 years of age, who in addition to chronic rheumatoid arthritis suffered great pain of the sciatic and intercostal nerves. I was unsuccessful in relieving the pain of the swollen and deformed joints, but the various neuralgias yielded satisfactorily to the influence of the high frequency currents. In

a letter written at the end of last February, a year after treatment was discontinued, the lady wrote me:

"This has so far been the best winter I have had for years. Last summer the pain was sometimes pretty bad, but since December came in I have been just remarkably well. There have been only two or three passing twinges of sciatica, so that practically I have had none for these three worst months of the year, and it is grand not to need to even think about my leg, for it does not trouble me in the least. The intercostal neuralgia, which you will remember did not yield at first to the treatment as we had hoped, has been entirely away for three months, except once or twice when I was out in cold winds, which brought back the pain for a day or two. I am wonderfully well. Even snow, which used to hurt me badly, makes very little difference now, and does not bring on sciatica at all. It is splendid to be able to go absolutely free about the house and up and down stairs 20 times a day without ever feeling any ill-effects. I am sleeping well and ravenous for every meal."

Although I cannot claim that in every case of neuralgia benefit has been permanent, yet temporary relief at any rate has been obtained. In my paper read here in February, 1903, I mentioned the case of a lady about 57 years of age, who, during the previous summer, suffered much pain along the course of the lower left intercostal nerves, extending well down the abdominal wall. Sedative liniments and massage had been tried without much beneficial effect. During August and September of 1902, while in the country, she was practically an invalid, and from being a lady of active habits she was compelled to keep her bed, as she became tired and exhausted on any slight exertion. The patient was very stout, and without the use of chloroform it was impossible to make a thorough examination of the abdomen, yet though her condition gave rise to an unpleasant suggestion of the presence of a neoplasm, nothing could be detected. This lady was treated by me in October, 1902, and after 18 visits the pain entirely disappeared, and she was able to resume all her active habits. Sorrow, bereavement, and overstrain caused the neuralgia to return in the spring of 1903. Again the high frequency currents were resorted to, and pain was dispelled. She kept remarkably well all summer, but has been compelled to return for further treatment during last month. Already, after a few visits, the pain has again almost entirely left her.

All the members of this Society who employ the high frequency currents are, no doubt, well aware of their beneficial influence in cases of internal hæmorrhoids. My first case, treated in September, 1902, was that of a gentleman about 40 years of age, where the hæmorrhoids appeared externally, and, where there was much local congestion, bleeding

and pain. After eight visits all bleeding had ceased and he experienced no pain, either while walking or at stool. On the cessation of treatment, Dr. Alexander Thomson, who had sent him to me, found, on examination, that the piles had lost their velvety character, and had become hardened and shrivelled. In January, 1903, the doctor again examined the patient and found the hæmorrhoids to have further contracted and to be still no source of trouble. I saw this gentleman two months ago, 17 months after treatment, when he described himself as perfectly well and free from all rectal discomfort.

Another case that presented itself in the autumn of 1902 was that of a lady who suffered from varicose conditions, both of lower limbs and bowel. I treated her at the time with success and was glad to find, when she had cause to return 15 months later for electrical treatment on account of an attack of acute rheumatic neuralgia of the arm, that the hæmorrhoids had given her no further trouble, and that the varix of the legs had remained in abeyance, permitting her to walk, and even to climb stairs, with ease, a condition that delighted her, for previous to the first treatment she had been unable to walk, or even to stand, without great discomfort.

A further instance of varix of the legs of long standing occurring in a lamplighter was dealt with in the autumn of 1902. The veins were not only swollen and tense, but the patient also suffered from a moist eczema in the region of the ankle joints which gave rise to intolerable heat and irritation. I have seen this man frequently going his rounds, and have always received from him the reply, in answer to my enquiries, that though the veins were still large, he was quite able for all his work.

In reference to the influence of the high frequency currents in certain skin affections, I mentioned the case of a lady about 55 years of age who suffered from psoriasis which was present in large patches over the hips, lower limbs and chest. The disease had been present for more than 10 years, yet at the time it yielded remarkably to treatment, and she remained scarcely affected by the eruption till the date of her death from malignant disease, about six months after treatment was discontinued.

Another case of psoriasis of the lower extremities, but of a much milder type, was treated by me in October, 1903. I was much surprised at the time to note how quickly the scaly patches disappeared till not a vestige remained. I had occasion to see this patient last month, when on examination I failed to detect any signs of the eruption.

I have just now under treatment two cases of psoriasis. In one where the eruption has been for two years all over the scalp, and where also a few small spots occurred on other parts of the body, the disease is yielding remarkably well to

treatment, to the delight and surprise alike of the patient herself, her husband, who is a doctor, and the medical friend who sent her to me.

On the other hand, I may mention that I have under my care at present, a gentleman who has suffered from a gouty psoriasis for 15 years, where so far as I can judge, no appreciable benefit has taken place, though he has visited me over 50 times. The high frequency currents are therefore, like other methods of treatment, not infallible.

It is very gratifying, both to patient and doctor, to be able sometimes to dispel a nervous headache, and this pleasant experience, by means of high frequency currents, is of frequent occurrence. Even in cases of persistent headache, lasting more or less for years, the effect of the high frequency currents is sometimes remarkable. A lady of over 30, the mother of several children, was sent to me in November, 1903, by Dr. Dick, of Dumbreck, suffering from headaches of many years' duration. For the past four years headache had been almost constant. She suffered also from sleeplessness, which may have been the cause or effect of the headaches. About 24 applications of high frequency currents were required to remove the headaches. Sleep returned to the extend of permitting the lady to sleep for eight hours at a stretch. Her hair, too, which had previously been coming out, showed new growth, and the change in her facial expression was most noticeable. Here the cure has been permanent, and though a pregnancy and the nursing of sick children have tried her nerve energy, yet she still remains free from headache, and with few exceptions enjoys a good night's sleep.

The high frequency currents have undoubtedly a marked effect in opposing insomnia. Many of the cases treated for various diseases have at the same time suffered from sleeplessness, and a double cure has been effected.

Several months ago I treated a young lady who was in every respect perfectly healthy, except that she was a bad sleeper and had been so for a year or two. The case required about 50 applications of high frequency currents, but in the end the insomnia yielded to the influence of electricity, and though several months have elapsed since treatment was discontinued, refreshing sleep, with accompanying increase of energy, is still enjoyed.

Again, I am able to quote a sustained and apparently permanent cure of asthma, as a result of high frequency treatment.

In September, 1902, I treated a clergyman who had suffered over a period of years from frequent attacks of asthma, especially on Monday mornings, after the strain of Sunday work. The asthma was evidently neurotic in origin ; it never troubled him while on holiday. With the exception of a short period, when his nervous system was depressed owing

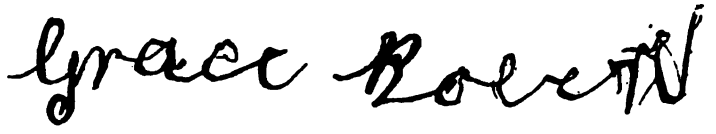
to an attack of influenza, he has been quite free from asthma, though it is 18 months since treatment was begun. I may add, however, that by way of prevention, he occasionally, on a Sunday evening, comes for a 15-minute sitting on the condenser couch.

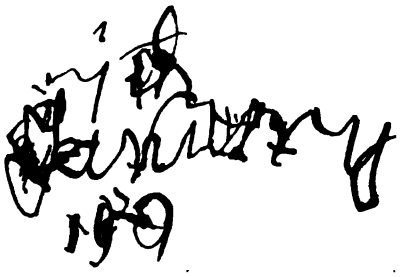
At my request, this gentleman has sent me the following note :—

"One of the many enquiries put to me, if I speak of the treatment, is as to the durability of its effects. To that my reply has been that where the evil dealt with is evanescent in itself or recurrent in its cause, as in the case of my weariness after a long day's work, its effect passes and needs to be renewed; but that where the evil is permanent, or more deeply fixed in the system, as in the case of my bronchitic asthma, a regular course of treatment produces permanent result; at least so I have found, for though even a simple treatment was a preventative or sedative, I have had no recurrence of my miserable experiences, except in connection with influenza, for 18 months, even during the winter life of a hard wrought city minister."

Mucous colitis is a condition which is usually persistent in character, yet here too I have found high frequency currents to produce excellent and lasting results. I have treated several cases, all, with one exception, having been benefited. One case I may specially refer to. A lady of over 40 was sent to me with the history that for 20 years she had been annoyed with mucous stools. Under high frequency treatment the excretion of mucus ceased and there has been no return, though the case was dealt with 16 months ago.

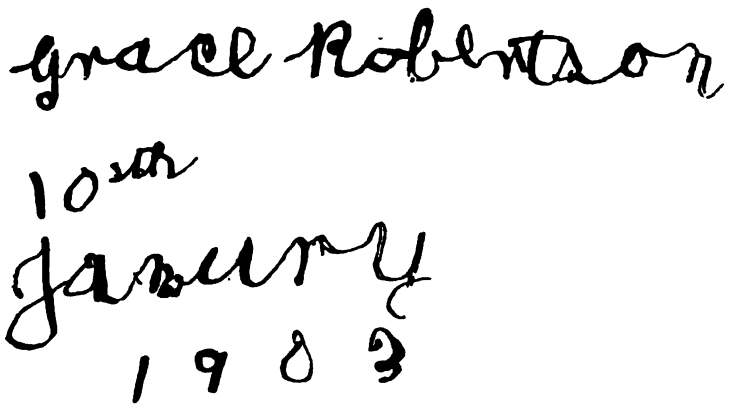
The high frequency currents have an undoubted effect in subduing choreic movements. I submitted to this Society in February of last year examples of handwriting before treatment,





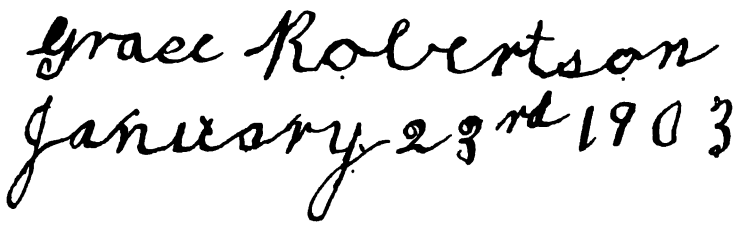
THE ABOVE DATE IS 7TH JANUARY, 1903. BEFORE TREATMENT.

after the third visit, and after the ninth visit, of a girl aged eleven who suddenly developed chorea 10 months



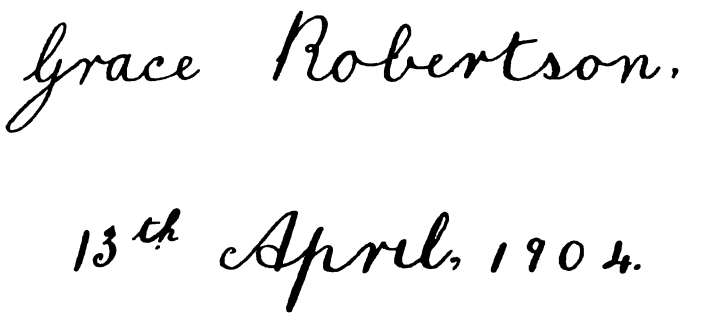
AFTER THE THIRD VISIT.

after an attack of rheumatic fever. During the attack, which was accompanied with high temperature, a mitral murmur



AFTER THE NINTH VISIT.

was detected, but rest in bed resulted in its disappearance. Lately the girl has again experienced a second severe attack of rheumatic fever, unaccompanied, however, with any cardiac complications. The specimen of her handwriting sent me last week, 15 months after high frequency currents were employed, and which I now show you, gives evidence that the patient remains entirely free from chorea.



FIFTEEN MONTHS AFTER TREATMENT.

It is undoubtedly true, as is often said, that those engaged in a particular branch of practice are in danger of over-estimating the value of their special methods; but it is equally true that they alone have the experience which enables them to speak with authority, and whilst exaggeration should of course be avoided, a frank relation of results is an obvious duty.

High frequency currents do not offer a universal panacea for all the ills to which flesh is heir, but they have a considerable field of usefulness, and this includes not only the temporary relief of certain forms of suffering, but decisive and permanent cure of many diseased conditions.

The President, in referring to the treatment of sciatica, thought that Dr. Somerville had very rightly emphasised the importance of distinguishing neuralgic pains in the sciatic region from those which were due to a perineuritis. It was with the latter type of case that most difficulty was found. Many sufferers from long standing sciatica had received improper treatment in the early stages and had had their complaint aggravated thereby. He felt sure that massage, exercises, and the application of strong induction coil currents was harmful in perineuritic cases. Rest, warmth, and the constant current should be used for these. For neuralgic sciaticas, on the other hand, counter-irritant methods were doubtless useful.

Dr. HORACE MANDERS: It is exceedingly gratifying to hear of such good and lasting effects following the application of high frequency currents, but the question arises: What applications? Was the same particular mode (effluve, condensation, etc.) used in each case, or were different modes used in different *séances* on the same subjects, or different modes to suit different patients?

As it is only by comparison with each other's practice that any real progress can be made in electrotherapeutics, I would ask the lecturer, for information only, and not in any spirit of cavil, if he would tell us the mode, milliampèrage, and material of production of high frequency used, as I find that quite a different effect is produced in the patient whether the interrupter is in a perfect condition or no. The comparisons made by the milliampèremeter on different patients are quite misleading unless the electrical disposition of material are exact.

Dr. DONALD BAYNES congratulated Dr. Somerville on his paper, but felt that Dr. Somerville should give us the technique of his applications. His paper puts one in mind of the old form of torture of holding a glass of water just out of reach of a man who was dying of thirst. For instance, how were the high frequency currents applied in varicose veins, piles (especially external), dilatation of stomach, headache, etc.?

Dr. BOLTON reported two cases of chorea which had been ineffectually treated by drugs, but yielded rapidly to high frequency currents. The method employed was auto-condensation and effluve. Cases of dilatation of the stomach were treated by means of one electrode in the rectum and one on the stomach. Headache was relieved in the following manner: The patient on the couch held an electrode connected with the top of the resonator; the operator placing his hand on the painful spot.

Dr. HERSCHELL brought forward a case in which severe colicy pains, following an operation for appendicitis, was permanently cured by the direct application of the resonator current to the abdomen.

He also wished to know if the cases of mucous colitis mentioned by Dr. Somerville were of the classical type, characterised by pain, constipation, and passage of membranes, or whether they were the ordinary chronic colitis, without pain, but merely an excess of mucous in the stools.

Mr. COWEN said he had had the opportunity of treating several cases of psoriasis by high frequency currents, and he had not obtained very satisfactory results. Two of these cases were undoubtedly gouty. Except in one case, where some local irritation resulted, he could not perceive any effect whatever from the applications so far as curing the original disease.

In some cases of internal piles the results of the applications were extremely satisfactory. On the whole, except for the relief of chronic neuralgic or functional pain, he had not been entirely satisfied with the therapeutic results of high frequency currents.

Dr. J. A. CODD asked whether any auxiliary treatment was employed. In sciatica, lumbago and neuralgia, and analagous conditions he found more benefit by placing the patient on the couch, connecting the bottom of the resonator to the condensation plate (instead of to the earth), and using an effluver made of a large bundle of fine wires spread out in conical fashion.

Pruritus ani, fissure and internal piles have yielded to the saline electrode and resonator current.

Anorexia nervosa has readily yielded to effluve in some cases. Warts are permanently cured by sparking, using the point of resonator electrode until the wart glows, when a blister is found to have developed under the wart, which may be snipped off.

Dr. HEYGATE VERNON mentioned a case of chronic superficial glossitis of two to three years' duration, apparently cured, relapsed after four months' interval, but rapidly improved on further treatment.

Case of subacute nephritis (severe dropsy): this disappeared under high frequency treatment, but tended to reappear when treatment was left off. High frequency treatment greatly increased excretion of urine, which diminished again when treatment was stopped.

Mr. CHISHOLM WILLIAMS remarked that in one extreme case of psoriasis, auto-condensation seemed the more effective form of electrical treatment. Cases of internal piles where there had been no previous operation were distinctly improved by a metallic electrode in actual contact. External were best treated by sparking with any pointed electrode. In both classes he considered general electrification by auto-condensation was of the utmost importance. In varicose veins he had only used auto-condensation, as the veins were only a local manifestation of a general condition. Headaches should be treated according to cause, but as this in the majority of cases could not be determined, then auto-condensation generally proved to be effective.

Any electrical treatment generally at first somewhat increased the pain. As a general rule, in any disease where pain was present, high frequency would generally increase it, hence great care should be exercised to commence with small doses and watch results.

In fissure of anus it was an open question whether the mechanical stretching or opening up of the fissure did not play an important part in the cure. Warts were particularly amenable to the high frequency spark, which, if properly used, was quite painless and thoroughly effective. Mr. Chisholm Williams wished to add his congratulations and thanks to the author of the paper.

In reply, Dr. SOMERVILLE thanked the members present for their kind reception of his paper. In replying to their criticisms he might say generally, that first of all the object of the paper was simply to attempt to prove the durability of the therapeutic effects of the high frequency currents, and secondly, as he was but a junior member of the Society, he felt that it was hardly his part at a meeting like the present, where the members were more experienced than himself, to enter into the details of methods of applying the high frequency currents. As, however, he had been asked to mention how the various cases were treated, he had now no hesitation in doing so.

In all the sciatic cases the patient lay upon the auto-condensation couch for five or 10 minutes, the maximum amount of milliampèrage available being employed. Massage through the clothing of the patient over the gluteal region and sciatic nerve of the limb affected was applied, the current meanwhile passing through the operator or more directly by

the bracelet and the hand. The effluve here was not used. In addition to the high frequency currents the nerve was vibrated by means of a vibrator driven by an electric motor. Patients suffering from skin affections were treated by the auto-condensation couch, thereafter by means of the effluve or brush directly on to the skin. In addition, a glass electrode of high vacuum, sometimes with a flat disc termination, at other times pointed, in connection with the top of the resonator was laid directly on the portion of the skin affected. He had found Dr. Herschell's handle of great service, as it enabled the operator to apply the current at first very gently, and afterwards to increase the strength unobserved by the patient. When dealing with patients suffering from headache, he massaged and sparked the head with the tips of the fingers, while the patient lay on the auto-condensation couch. He also employed the local breeze with the brush, both over the head and down the neck. It had not been his experience (like that of Dr. Chisholm Williams) to find that headaches were at first increased by treatment. On the contrary, he seldom failed to give relief within a few minutes. Cases suffering from insomnia were treated with the couch, the brush discharge, and massage of the upper part of the spine directly on the skin. Hæmorrhoidal cases and those where fissure of the anus was present, in addition to the auto-condensation couch, had a metal electrode attached to Dr. Herschell's handle introduced into the rectum. Those suffering from mucous colitis of the usual type had the current passed by means of the tongue electrode from the mouth along the alimentary tract to the metal electrode placed in the rectum. Electrical massage of the abdomen was made use of, the operator through whom the current was conducted, passing his hand directly over the skin of the abdomen. In chorea he did not employ the effluve, but simply the couch and electrical massage of the affected limbs through the clothes. The cases in which varicose veins were present he treated by the couch, the brush discharge, and direct application of the glass electrode attached to the top of the resonator. The case of asthma was treated chiefly with the couch, but electric massage of the back and the application of the effluve from a very large brush were also employed. In respect to the sciatic cases, Dr. Somerville agreed with the President in his remarks regarding the importance of diagnosing between a simple neuralgia and a perineuritis giving rise to adhesions between the sheath and the nerve. During the treatment of his cases by the high frequency currents drugs were withheld, and in the chorea cases even rest was not enjoined.

Dr. CODD showed an Automatic Current Alterator or Rhythmic Interrupter. It is a device for giving a patient a

heavy dose of constant current and at the same time throwing in periodically an extra current of a few milliampères, thus producing a muscular contraction.

A patient cannot stand a complete break of a heavy current, say 50 to 100 milliampères, and the simple continuous current produces no muscular contraction. Also the make and break of a small current fails in the trophic influence of heavier currents.

It consists of a metronome, with the weight having a light piece of spring steel attached, which dips at every second beat into an iron mercury cup, carried on a brass arm so contrived that whatever the position of the weight, the cup can be slid along the arm and clamped in a position to receive the steel arm of the weight. One of the wires from switchboard or battery to patient is broken and the two ends brought to the terminals of the apparatus. Two circuits connect these terminals. One passes through a graphite rheostat with a resistance varying from 0 to 1,000 ohms. The other passes through the mercury cup and dipper, so that every time the dipper dips in the cup the resistance is short-circuited.

The procedure is as follows: Resistance being out, metronome at rest, the full current you intend using is gradually turned on, say 70 milliampères. The graphite resistance is gradually put on till the current is reduced by the required variation, five milliampères is generally enough with this current. When the dipper enters the mercury the current will immediately rise from 65 to 70 milliampères, and the patient will experience a brisk but not unpleasant muscular contraction. The graduations on the instrument should be halved to get the correct periodicity of the variations.

The instrument shown was made for Dr. Codd by his brother, Mr. L. B. Codd, of Dame Agnes Street, Nottingham, from whom it may be obtained. It may also be obtained from Mr. K. Schall, Great Marylebone Street, W.

The President thought Dr. Codd's rhythmic interrupter was likely to be of value in many cases. It was becoming gradually recognised that rhythmic alternations of periods of stimulation and periods of rest were essential for electrical applications to nerve and muscle.

NOTICES.

Members taking part in discussions or making remarks on papers, etc., are earnestly requested to give their notes on same to the Secretary at the end of evening, so that the proceedings may be complete and not delay the prompt publication of the Journal.

Members are reminded that the annual subscription (one guinea) became due January 1st, and should be sent to either Honorary Secretaries at their earliest convenience.

The Secretaries will be pleased to hear from any member willing to read a paper, etc., at any future Meeting. The dates are: July (Oxford, business only), September 23rd, October 28th, November 25th. December (Exhibition).

Dr. Horace Manders has kindly promised a paper for 27th May.

On June the 24th the second Annual Dinner will be held, when it is hoped that the members will give the committee their hearty support. Dr. Samuel Sloan will read a paper at the Ordinary Meeting.

In July a business meeting will be held at the Oxford Meeting of the British Medical Association, date will be announced later.

MEDICAL

Electrology and Radiology.

No. 6. JUNE, 1904. VOL. V.

EDITORIAL.

Not least among the many important properties that particularise and help to distinguish the essentially radio-active substances, like Radium and Thorium, from those that owe their radio-activity to influence or induction, are the emanations which these bodies give off. It is these agencies, that by impenetration and diffusion through their mass render neutral substances, whether liquid, solid or gaseous, radio-active, when they are brought into immediate relation with an active source of such energy. That the phenomenon, known as induced radio-activity, is to be attributed to the action of the emanation, and not to that of the rays upon the bodies so influenced, is capable of exact experimental demonstration. The interposition of a screen of tinfoil or lead, of a thickness sufficient to completely intercept all the rays emitted, does in nowise interfere with the transference of this form of energy, so long as the emanation has access to the substance which it is sought to influence. On the other hand, the enclosure of the radio-active substance with its emanation in a hermetically sealed tube that is transparent to all radiations, has been found to prevent any communication of radio-activity. The molecular weight and gaseous nature of radio-active emanations were first determined by Professor Rutherford of Montreal, who, working in conjunction with Soddy, has shown that the emanations, like other substances in the gaseous state, are condensed by cold, 150° being required for the emanation of radium, whilst 120° is sufficient for that of thorium. It is indeed remarkable that emanations, even when present in too minute a quantity for clinical recognition, can still reveal their presence by their radio-active properties and appear luminous in the dark. The radio-activity of emanations have

been found to decrease with time, that of thorium diminishing more rapidly than that of radium. The last remark must, however, be understood as referring to gaseous admixtures, as the radio-activity induced in solid substances by exposure to thorium emanations is more lasting than that caused by the emanation of radium. This difference in the behaviour of solid and gaseous bodies, temporarily endowed with radio-activity is a point of great clinical importance, as the rate of disappearance of radio-activity in an emanation directly determines the rapidity of its reproduction. Radio-active emanations have hitherto proved as refractory to all chemical reactions as argon. In an electrical field they are displaced towards the cathode, thus showing them to be positively charged. The same inference has also been arrived at from the appearance of Lichtenberg dust-figures of the mixed variety when exposed to radio-active emanations. It has similarly been noticed that induced radio-activity is always most intensely manifest in bodies that are negatively charged—a point, the importance of which has not as yet been fully recognised in medical practice. According to Ramsey and Soddy, Curie and Dewar, the emanations furnish us with a spectrum hitherto unknown; whilst their enclosure in a Geissler's tube, through which an electric current is discharged, results in their transformation to helium.

It would be absurd in the present embryonic stage of our knowledge of the subject to claim that it is possible, with any degree of certainty, to predict the exact sphere of therapeutical application of radio-active emanations. There is some reason to believe that the waters of several Spas and the mud baths, so successfully employed on the Continent, owe not a little of their remedial virtue to the emanations they contain. Even apart from this, evidence is not wanting to predicate their great therapeutic possibilities in the local treatment of diseased conditions of the respiratory tract, more especially of the parts accessible to the Tidal Air.

SMITH *v.* PARE.

The action of Smith *v.* Pare, which was tried before Mr. Justice Lawrence and a special jury, has ended disastrously for the plaintiff. It was brought by Mr. E. A. Cloete Smith, M.R.C.S., L.R.C.P., of 1, Westbourne Street, Hyde Park, as plaintiff, to recover a sum of 100 guineas for professional services rendered to the wife of the defendant, Mr. W. Luscombe Pare, of 3, Courtland Terrace, Kensington. Damages were also claimed for assault. The defendant, who denied liability as to the claim on the grounds that the treatment of his wife had been negligent, unskilful and wholly useless, counter-claimed for damages from the plaintiff for negligence in improperly treating Mrs. Pare, and paid £2 into Court in respect of the assault, which he admitted.

In the *Pall Mall Gazette* of February 27th, 1903, a short article, written by Mrs. Helen Black, a lady journalist, appeared under the heading, "A Triumph of Electricity." In it attention was directed to a new treatment for the cure of cancer by high frequency electricity, and also to the opening of a hospital for the application of this treatment. The discovery was placed to the credit of a "doctor," living "in a handsome house not a hundred miles from Hyde Park," who was "one of the first and foremost private medical men in this line," and "one who may, in all truth, be said to have advanced even a step or two further than any other." In a printed leaflet and a circular letter, sent in reply to requests for information, the same treatment was advocated as being preferable to that by the Röntgen rays. In these the alleged cure was associated directly with Mr. Cloete Smith. It chanced that one of these circulars—of which some 350 were issued before their circulation was eventually stopped by a telegram from Mr. Cloete Smith—came into the possession of Mrs. Mary Batten, a sister of Mrs. Pare, who forwarded it on to the defendant.

From the evidence given at the trial, we learn that Mrs. Pare had in 1899 been operated upon by Sir Victor Horsley for an internal growth, of such a character that recurrence was not impossible. The wound of operation healed rapidly, and there was no subsequent recurrence; but in September, 1902, she suffered from pneumonia and blood-poisoning, which rendered her condition very serious. Mr. H. Huxley, who was consulted, recommended the open-air treatment. She was therefore sent to St. Leonards, where she remained from February to April. In March last year her condition was regarded as critical and nearly hopeless. It was at this period of anxiety that the circular,

written by the lady journalist, describing the great success of the new and painless cure by high frequency electricity, reached Mr. Pare. He was pressed by his wife's relatives to see Mr. Cloete Smith. Having previously mentioned the matter to Mr. Huxley, he called on March 9th, in company with his sister-in-law, on Mr. Cloete Smith, showed him the circular, and discussed the plan of treatment in reference to his wife's case. As to what actually transpired at this interview there is a conflict of evidence, Mr. Cloete Smith stating that he told the defendant that the treatment he considered advisable for his wife's case was the high frequency current for her general condition combined with the X-rays, whereas Mr. Pare maintained that the high frequency treatment alone was mentioned, and that nothing was said about the X-rays, to whose use he neither consented nor was asked to do so. At this interview, however, it was arranged that the plaintiff should treat the patient, subject to the opinion of Sir Victor Horsley and Mr. Huxley.

From the evidence of these gentlemen there appears to be no reasonable grounds for doubt as to the nature of the opinions which Mr. Pare received. It was that high frequency currents would not be likely to do his wife any harm, though they could do her no good. There was no consultation with Mr. Cloete Smith, as Mr. Huxley declined to meet any doctor who was connected with what he considered was an advertising circular. As no serious objection was made to the high frequency treatment, the defendant telegraphed to the plaintiff to say he had decided to avail himself of the plaintiff's services. Mr. Cloete Smith, acting thereon, went to St. Leonards, arranged the apparatus, and made a complete examination of Mrs. Pare. The electrical treatment of the case he entrusted to Mr. Chaplin, who is an unqualified medical electrotherapeutist; as both Dr. Inglis and the nurse in charge of the case declined to take any responsibility with regard to the same. He instructed Mr. Chaplin to give the patient two hours of the high frequency current twice a day if she could bear it, and administer the X-rays from a distance of 16 to 20 inches from the body, allowing the operator at the same time to use his own discretion as to the length of the exposure. This plan of treatment was subsequently modified by the entire abandonment of treatment by high frequency, whilst the X-rays continued to be applied. The high frequency treatment was discontinued in consequence of a telegraphic communication made by the nurse as to their effects upon the patient. The plaintiff visited Mrs. Pare from time to time, and saw her in consultation with Dr. Inglis, of St. Leonards. Owing to the weak and nervous condition of the patient the nurse, acting on her own responsibility, stopped treatment. Early in April

Mrs. Pare returned to London, where she was visited by Mr. Cloete Smith, and the X-ray treatment continued to be administered at Courtland Terrace by the nurse acting on the plaintiff's instructions.

On the appearance of a dermatitis on April 13th the nurse stopped the applications. Mr. Cloete Smith, having regard to the dermatitis, then directed that the applications be continued, but with a shorter exposure. As the skin eventually became very sore, the nurse once again stopped the applications and used a lotion prescribed by the plaintiff. This dressing, besides causing a good deal of pain, brought the skin off. On April 29th the plaintiff was, by a letter from Mrs. Pare, dismissed from further attendance. When the plaintiff left the case Mrs. Pare was in a serious condition, and in the second week in May she was alarmingly ill. From that time up to July her condition gradually improved, though the burns continued very painful. When examined last month by Dr. A. H. Greg, superintendent of the X-ray department of St. Thomas's Hospital, on behalf of the plaintiff, the X-ray burns were still apparent, although the treatment had ceased 12 months ago. The defendant, although he had heard of the burns in April, first saw his wife's condition on June 9th, and was much shocked and indignant. He went to the hospital, met Mr. Cloete Smith, and assaulted him. Among the statements made by the medical witnesses in their evidence, the following deserve attention :—

Dr. A. H. Greg, chief of the X-ray department at St. Thomas's Hospital, said he had last month examined Mrs. Pare, and assuming her condition to have been as described by the plaintiff and Dr. Inglis, he was of opinion that a remarkable cure had been effected. Cross-examined, he admitted that he had never known of a case in which X-rays had cured the internal complaint from which Mrs. Pare was suffering. These rays, as likewise high frequency applications, had the effect of relieving pain. No good purpose could be obtained by so severe a burn as in this case. He considered it would have been judicious to have warned the patient as to the possible results of treatment.

Mr. H. Huxley, in his evidence, said there was no evidence that X-rays had any effect on deep-seated disease. On cross-examination, he admitted that he had had no experience of the use of X-rays for therapeutical purposes. If he had any faith in X-ray treatment he should apply it to that part of the body where there was evidence of disease. He was of opinion that in the case of treatment of this kind the consent of the husband and wife should be obtained, and the nature of the treatment fully explained to them.

Sir Victor Horsley, in his evidence, said the therapeutic use of X-rays was perfectly well known, and it was also known

that they had no effect upon internal malignant disease. He thought the treatment should have been fully explained to the patient and her husband, and their consent obtained.

Cross-examined by Mr. Duke: He said he was aware that the high frequency current was employed in the case of X-ray burns; but it was not considered because the treatment did not suit Mrs. Pare. There was a question as to whether the symptoms pointed to a malignant disease; but X-ray treatment was only of service in external cases. The X-ray process was quite a new subject and was used for curative purposes, but it was of no use for internal disease. The occurrence of a severe X-ray burn was the exception after such treatment, and it was perfectly well known how to avoid such burning. He had never seen such a case as the one in question. The burning would to some extent depend on the susceptibility of the patient.

Re-examined: It had been proved that the X-ray did not penetrate beyond the skin. He thought that the case was unique as regards the damage done by burning. Every possible precaution ought to be taken to prevent dermatitis, and the rays ought to be limited to the smallest possible area. In his opinion there was no medical justification for the treatment which had been applied.

The Judge, after summing up, left three questions to the jury. The first was as to whether Mr. Pare had consented to the use of the X-rays; the next was whether the treatment was proper treatment to apply; and the last whether the burning of Mrs. Pare's skin was caused by negligence and want of reasonable skill. The jury found that Mr. Pare did not consent to the plaintiff's application of the X-rays to his wife; and that the treatment was improper, negligent, and unskilful. With regard to the assault, which was admitted, the only question was as to the damages: this the jury assessed at £2, the amount paid into Court. In regard to the counter-claim they found a verdict for the defendant for £100. In consequence of these findings, judgment was given for the defendant both on the claim and counter-claim, with costs. A stay of execution was refused.

In commenting on this case, we must say that the use of lay assistance to carry out the immediate electrical treatment of a case cannot be too strongly condemned. The unqualified assistant has been banished from general medical practice, and it is only in the domain of electro-therapy that the employment of such aid is tolerated. Surely an electrician, however vast his knowledge of physical electricity may be, is no more fitted to dabble with the treatment of disease than a surgical instrument-maker to perform a laparotomy, or an optician to treat cataract or diseases of the fundus. Nor yet can this deficiency of medical

knowledge be overcome by his association with the practitioner in attendance on the patient.

The evidence of the medical witnesses, like everything else in the case, is interesting, instructive, and—open to criticism.

With due reference to the views expressed, we venture to say that the X-rays do, as a matter of fact, penetrate beyond the skin; that they are not without influence on tissues more deeply situated, especially on those in which cellular metamorphosis is rapid; and that it would be more in keeping with the dictates of unbiased judgment to leave their effects upon internal cancer an open question, till sufficient evidence accumulates to warrant a proper decision. An emphatic assertion that X-rays have a pronounced remedial effect on such cases is not more justifiable than the unqualified denial of their powers in this respect. In the present state of our knowledge both statements are, to say the least, premature; and however valuable they, as the pious opinion of an individual, may be, still are by no means to be confounded with the more cautious, reliable, and very guarded views of those best qualified to speak on electrotherapeutical questions. Again, considering that the exact cause of X-ray burns has still to be worked out, it cannot legitimately be claimed that we have any reliable knowledge of the precautions necessary to prevent their occurrence, nor yet, even if this were known, would it be judicious, until our acquaintance with the physiology of X-ray treatment be sufficiently advanced to justify such an assumption, to postulate that every possible precaution ought to be taken to prevent it; as not a few operators, whose observations are worthy of consideration, are of opinion that some degree of dermatitis is a desirable adjuvant, if not quite an essential, to treatment. To prevent all likelihood of misconstruction, we, in concluding our remarks, assert that *no good purpose can be served by the production of so severe a burn as in this case.*

J. E. Stubbert presents a historic sketch of some of the so-called cures for pulmonary tuberculosis, with a few notes on latter-day treatment. The various therapeutic methods in vogue to-day, including drugs, light, electricity, water, serum, intravenous and subcutaneous injections, inhalations, etc., are all considered. In the light of present knowledge, diet, hygiene and fresh air are universally accepted as the foundation of all scientific treatment. Upon indication they must be supplemented by symptomatic treatment in the way of antiseptics, tonics, and surgical interference. The probability Stubbert believes is that within three years notable advances in immunization, and stimulating effect of *light* will be seen.—*The Medical News*, April 16th, 1904.

PRACTICAL LESSONS IN THE TREATMENT OF AFFECTIONS OF THE GASTRO-INTESTINAL TRACT BY ELECTRICAL METHODS.

By George Herschell, M.D., Lond.

(*Continued from p. 190.*)

Treatment of Persistent Hiccough.

Electricity is certainly worth trying in the cases we occasionally meet which resist ordinary measures. This is exemplified by the following interesting case:—

The patient, a woman aged 24 years, attended my out-patient clinique for the first time on October 26th, 1895, complaining of hiccough, which had persisted almost continuously for a week. This had apparently come on after a period of worry. As she was very anæmic, the Hb. being 30 per cent. with an erythrocyte count of only 2,300,000, she was given iron and arsenic with some improvement, the attacks occurring several times a week. In April, 1896, she had a very severe attack at the hospital in the waiting room, of such a serious nature that several times she appeared moribund. She was at once taken into the consulting room and the constant galvanic current applied, the anode being attached by a bifurcated rheophore to two electrodes, which were placed respectively on each side of the neck whilst the cathode was applied to the epigastrium. The effect was almost instantaneous, and in a few minutes the attack had completely passed off. She remained free for some weeks, when on its returning she was admitted an in-patient. The treatment adopted was the daily application of the constant galvanic current in the manner described, the procedure being varied by placing the cathode on the nape of the neck. From 10 to 15 milliampères was made use of, the current being very slowly and gradually increased in order not to produce vertigo. After remaining in hospital about two months she was discharged. The cure was completed by applications twice a week for a longer period in the out-patient room.

(This case was reported in the *Lancet*, 1897, vol. 2, p. 1,451.)

Treatment of Intestinal Colic.

In several cases of intestinal colic of obscure origin I have seen the most beneficial results follow the application of high frequency electricity.

Capt. T. was sent to me by Dr. Kingscote on July 26th, 1902. He had been operated on for appendicitis by

Marmaduke Shield in May, 1900, who described the case in a letter to me as one of the worst cases of septic peritonitis which he had ever seen. Since the operation the patient had suffered from attacks of abdominal colic of a very severe nature, in many ways closely resembling cholelithiasis.

These attacks were supposed to be due to adhesions. At the wish of the patient, without, I must confess, much expectation of doing him good, I commenced the daily application of the high frequency currents. From the commencement of the treatment the attacks ceased, and he remained free from them until November 14th in the same year, when he came to me suffering from acute pain. This pain, which was of some hours' duration, disappeared during the application of the effluve from the resonator. The patient took a course of three weeks and to my knowledge has remained free from attacks to the present date.

In this case it is evident from the effect of treatment that the diagnosis of adhesions could not be maintained, as it is difficult to imagine any form of electricity having so marked effect upon them. The duration of the first course of treatment was six weeks, and the application used was the local application to the abdomen of the effluve from one end of the d'Arsonval coil of high tension. The patient during the application reclined upon the condensation couch, the metal plate of which was attached to the other end of the coil.

The second case was a country solicitor, aged 48, who came under my notice in August, 1902. For some years he had suffered from almost weekly attacks of some severity. The attack would commence about the middle of the afternoon with nausea. To this succeeded colicy pains in the abdomen which would reach their acme of intensity about midnight. From this point they would gradually decline, until by breakfast time they had usually disappeared. During the height of the pain vomiting would take place but without relief to the pain. There were no symptoms of tabes, the gastric motility and secretions were normal, and no gall-stones had ever been detected in the evacuations. There had never been the slightest trace of jaundice. The precise position of the pain was in the lower abdomen over the right quadrant.

In this interesting case the only conclusion at which we could logically arrive was that the pain was of the nature of colic, due possibly to some undiscovered reflex irritation. The fact that digestion was normal, and that no disturbance of the intestines such as diarrhœa was present, together with the absence of mucus stools, excluded mucous colitis and other irritations arising within the bowel. It was experimentally proved that different articles of diet had no effect one way or the other in producing, increasing, or alleviating the pain.

Treatment was commenced by the daily application of the current from the ends of a small solenoid of 10 spires four inches in diameter, one pole being applied to the abdomen by a moistened electrode, and the other inserted into the rectum by means of the author's rectal electrode figured in the accompanying illustration. This electrode is designed to be used when the patient is lying upon his back, the attached rheophore passing under his flexed thigh.

The precise form of this electrode has been arrived at only after many experiments, the desideratum being a piece of apparatus which could be easily introduced, which would be self-retaining, and by its curve would conform to the position of the parts when the patient was in a supine position. For the sake of lightness it is constructed of aluminium.

The Author's Rectal Electrode for High Frequency Currents.

In the above case the treatment was administered daily six days a week for 10 minutes at a time, the total duration of the course being six weeks and the dose from 250 to 350 milliampères. At the end of the first week a slight attack was experienced. With this exception the patient has been free from pain to the present time.

Chronic Enteritis.

The use of electricity is a valuable adjuvant in the treatment of those cases of catarrh of the large bowel, which are associated with constipation and the excessive secretion of mucus. As we all know, the intensity of the affection may vary from the slight mucous colitis so frequently met with among neurasthenics, characterized by an almost complete absence of pain, by constipation and the passage of fæces in hard lumps covered with mucus, to the typical muco-membranous colitis, so often described in text-books and so comparatively rarely seen. We must, however, distinctly understand that no electrical method can replace the treatment by appropriate diet, oil injections, and internal medication, which must in every case be carefully carried out, although I think that we may fairly claim for electricity that it will shorten the duration of necessary treatment in every case, and will enable us to often effect a cure in cases which are rebellious to ordinary measures.

In the early stage and in slight cases of mucous colitis I have found the best results to be obtained by—

Currents of High Frequency, using the bipolar method in derivation from the small solenoid. One pole is inserted into the rectum by means of the electrode already described, and the other is placed upon the abdomen. This latter electrode should be of large size, and may consist of a well wetted felt-covered metal plate with a piece of animal membrane interposed between it and the skin of the abdomen, or of a bare, well polished metal plate. The duration of the application may be at first four minutes gradually increasing to ten. During the session the electrode should be placed in succession on points along the course of the colon, commencing in the right iliac region and finishing in the region of the sigmoid. On the occasion of the first application we should not give a larger dose than 100 milliampères, but we may gradually increase this from day to day until we reach 350, 400 or even 500 milliampères.

A very useful electrical application, which unfortunately has been too much neglected in these cases, is the—

Hydro-Electric Douche.—With this method we may use the constant galvanic, the induced, or the sinusoidal current, one electrode being applied to the abdomen, and the other formed by saline liquid, which has been introduced into the rectum. There are two distinct methods of giving the hydro-electric douche. In the one, a certain quantity of liquid is introduced into the bowel and retained until the close of the operation ; in the other and better way we conduct a continuous flow of liquid into the bowel, from which it escapes by a second channel. We thus secure the well-known beneficial action of the continuous irrigation plus the electricity.

Method of Giving the Hydro-Electric Douche with a Single Tube, and the Constant Galvanic Current.—First of all prepare one quart of warm salt and water about a teaspoonful to a pint. Place the patient on his back upon the bed, with his knees drawn up and his feet resting upon two chairs at its side. His buttocks should be level with the edge of the bed. Under the patient put a Kelly's douching sheet, with the end hanging into a basin or foot-bath placed on the floor alongside the bed. With this precaution there will be no mess in case the patient should be unable to retain the fluid. Upon the abdomen place a flat electrode well moistened in the usual carbonate of soda solution, and connect it with the positive pole of the battery. Attach the other pole to the rectal electrode, the tube of which has been already connected with the douche can. The can or irrigator may be conveniently placed upon a chair standing

on the bed beside the patient. Now open the tap of the irrigator and allow the fluid to pass gently into the rectum. As soon as the patient commences to feel a slight discomfort turn off the tap and commence to increase the galvanic current from zero up to fifteen milliampères. After a few minutes reduce the current to zero and reverse it. Now raise it again to fifteen milliampères, reduce again to zero, reverse and raise again. After ten minutes of this treatment withdraw the electrode and allow the patient to empty his bowels.

Method with Continuous Irrigation.—The *modus operandi* will be virtually similar to the method just described, with the exception that the douching sheet will not be required as there will be no danger of the patient involuntarily emptying his bowels. A double current electrode is employed, which will allow the fluid to leave the bowel by one tube, whilst it enters by another. The only important point to bear in mind is to compress the efferent pipe so that no water can leave the bowel until at least a pint has been introduced. When this has taken place we open the clip, and the diameter of afferent and efferent tubes being equal, it follows of necessity that the bowel will continue to retain this amount during the duration of the treatment, otherwise we should never succeed in filling the rectum, as the water introduced by one tube would at once escape by the other. When giving the hydro-electric douche by this method we should be prepared with at least two gallons of saline solution, and replenish the douche can with it from time to time as the level of the liquid falls. In no case must the douche can be higher than two feet above the level of the patient.

In more advanced cases and in true muco-membranous colitis I have obtained the best results from the—

Triphase Alternating Current.—This I have usually employed in the manner already described, with one pole in the rectum and two upon the abdomen, but it may equally well be given by either of the hydro-electric methods. It is important in all these cases, whatever local means we may be employing, not to neglect general tonic measures. Static electricity, the condensation couch, the sinusoidal bath, will all materially help us to restore out patient to health.

(*To be concluded.*)

ON THE METHODS OF APPLICATION OF HIGH FREQUENCY CURRENTS.

By Clarence A. Wright, F.R.C.S. (Ed.), &c.

(Continued from p. 198.)

(b) *The Character of the Discharge.*—When we turn to the character of the discharge we at once notice that there are variations to be ascribed to this cause. Thus, when we regard the cases treated by the effluve for 2 minutes, we at once perceive that although the degree of surface anæsthesia was slight, yet it extended more deeply into the tissues than in corresponding parts treated by eucomides for a similar period. Five such investigations were made. In one case the needle passed to nearly double the depth in the effluvated arm before it caused the same degree of pain as in that treated by spark discharges. In the other cases similar results were noticed, although the difference was not so accentuated. In five persons effluvated on one arm alone the insensibility extended to 2¼ times the depth in one case; and to little more than 1½ times in two cases; whilst in the remaining two no difference could be perceived. This insensibility for needle stimulation also lasted longer for effluvated parts than for those treated by eucomides. In seven cases treated to sessions of 5 to 8 minutes I perceived a slight increase in the surface anæsthesia for strong irritant applications, but it was unquestionably more than in the cases treated by eucomides for a similar period. The irritation produced by weaker irritant applications was also longer in making an appearance in effluvated spots than in those treated by eucomides. In the four cases reserved for this test it did not appear till 10 to 14 minutes after the end of the session, and even then continued moderate for more than half an hour, whilst none of the cases submitted to eucomides could be induced to tolerate it for more than 20 minutes. Our investigation as to pain perception (needle stimulation) proved a similar increase in the degree of deep anæsthesia and in the duration of its continuance. From these observations we are led to believe that whilst the degree of surface anæsthesia is less pronounced in eucomidial applications than in the effluve-method of treatment, it does not continue so long marked for minor irritations as in cases treated by the latter method; whilst deep anæsthesia is, both as regards its limits and duration, more favourably influenced by the effluve than by the eucomides.

(c) *The Tension and Density of the Current.*—The experiments made induce us to believe that the tension of the

current has a considerable influence upon deep anæsthesia, while the current density seems more to affect the degree of surface insensibility. A comparison of results obtained both by single and double effluvation substantiate this; for the minor variations are to be attributed to the kind of electrode employed. The effect of treatment by vacuum tube or condenser electrode show this very clearly when compared with that by the fluid electrode.

(D) *The Method of Electrification of the Body.*—We have found that this important factor has an influence upon the results observed; for both surface and deep anæsthesia were better marked in cases treated by receptive effluvation than in those treated by the eductive method.

(E) *The Varying Resistance of the Skin.*—If we compare the effect of discharges (both eucomides and effluve) upon the different parts of the body we at once perceive that anæsthesia cannot so readily be produced in parts covered by considerable layers of horny epidermic scales as in those in which the texture of the skin is finer. Again, the effects upon patients suffering from epilepsy, dropsy, scleroderma differ much from those noticed in cases of hysteria, anæmia, and tuberculosis. These differences in effect are more than a matter of individual peculiarity, being due rather to the variations in the resistance of the skin caused by the disease; in much the same way as the normal variation in the texture of the skin affects the reaction.

EFFECTS UPON THE SKIN.—The first appreciable effect that the discharges have upon the skin is to set up a spasmodic contraction of its capillaries. This is more noticeable with sparks than in treatment by the effluve. The vaso-constriction thus produced is evidenced by a pallor of the skin and an erection of its papillæ. As the session proceeds (*i.e.*, after 5 to 8 minutes of the effluve or 10 to 40 seconds with sparks) the spasm relaxes and gives place to a dilatation in every degree proportionate to the preceding contraction. About this time an erythematous flush overspreads the surface and gradually increases till it reaches its maximum intensity in about 30 minutes. The redness usually lasts for 3 to 8 hours after an application of as many minutes, although traces of it may be still discerned on the day following the application. I have often had occasion to remark how, even on the third day, the use of a rough towel, as in bathing, brings out in all its pristine fulness the roseate hue of the parts submitted to the discharge. In cases treated by *sparks* the cuticular reaction is not of necessity limited to a surface erythema; for blisters, and even a true necrosis of the tissues can be set up by too long an appli-

cation. A similar trophic change has been observed, in certain diseased conditions of the skin, in cases treated by the *effluve* with sessions lasting for more than 20 minutes. On the second or third day after treatment a slight branny desquamation takes place. This is more noticeable in some cases than in others. Another effect of local applications worthy of mention is the outbreak of a sensible perspiration upon the parts operated upon. This may occur towards the end of the session or after its termination.

SYSTEMIC EFFECTS OF EFFLUVATION.—Although receptive effluvation has some effect upon general nutrition, it is less marked than in treatment by the eductive or bipolar method. In comparison with the dynamic effects of general arsonvalisation it must be admitted that the static effects are trifling, yet it is none the less a factor of importance. The effects of local applications upon respiration and circulation have therefore to be separately considered.

Effects of Effluvation upon Respiration.—The results of experiments made upon rabbits and monkeys clearly prove:—

(A) The activity of the respiratory centres is considerably increased by *effluvation of the Vertebral Spine*, so that the respirations become both quicker and deeper, whilst at the same time more respiratory work is done.

(B) *Effluvation of the Thorax*, on the contrary, causes accelerated but shallow breathing, alternating with slow, deep respirations, with an occasional stoppage in the position of full inspiration.

(C) *Effluvation of the Anterior Abdominal Wall*, more especially when the discharge is directed against the epigastric region, causes the respiratory movements to become very rapid at the commencement of the session, with a subsequent slowing of the movements, which become more marked the longer the administration is continued. The pause is here in the position of full expiration.

(D) Effluvation of a limited area of skin upon either the upper or lower extremities seems to be without any special effect upon respiration.

Effects of Local Applications upon the Circulation.—In local arsonvalisation the systemic reaction depends in part on the dynamic effects of the currents, and in part on the static effects of the discharges, the latter being the predominant factor. Moutier, Doumer, Leduc, and Oudin have shown :—

(*a*) The passage of the discharge, more particularly of sparks and eucomides, causes, at the point of application and for 1 to 2 cm. above it, a well marked spasmodic anæmia of he skin, which becomes chalky white, while its papillæ erect

themselves. This blanching of the skin, due to energetic vasomotor contraction, in time gives place to an erythematous blush as well marked as the preceding contraction, but of longer duration (Leduc).

(*b*) *A Considerable Increase in Blood Pressure*—Moutier has by local applications to the vertebral spine (working chiefly in a downward direction) been able to produce, by the discharge of sparks or even by the effluve, a rise of pressure equal to 8 cm. of mercury. Doumer has confirmed this experiment of Moutier's. Denoyés claims that arterial tension can be more rapidly raised by this procedure than by any other method at present in vogue, not excluding the transfusion of artificial serum. He cites in support of his contention a case of anæmia treated by Oudin, in which a rise equal to 9 to 14 cm. of mercury was noticed after a single session. Reus, Crooneg, and Leduc record similar rises of blood pressure after effluvation.

(*c*) *Vasomoter Contraction of the Capillaries.*—This was first established by Oudin, who by means of a Laulanie spygmomanometer examined the tracing of the capillary pulse. He found that the moment that the effluve from a resonator touched any part of the body it instantly produced in the capillaries of the part a spasmodic vasomotor constriction, with a corresponding decline in the general pulse curve. He has also proved that a diminution in the amplitude of pulsations occurs, which in some cases almost amounts to a total suppression. After the cessation of treatment the pulse rapidly resumes its former character, but only regains its amplitude after a considerable period, during which the tracings record a progressive decreasing series of minor vasomotor oscillations. Doumer and Oudin therefore recommend this treatment for diseases characterised by diminished activity in the nutritive exchanges and in chronic local inflammations due to arterial or venous stasis.

CONDITIONS THAT INFLUENCE THE LOCAL REACTION—It is evident from what has been already said, that the technique of local applications is susceptible of great variation, and that many of the modifications so introduced have a distinct bearing upon the character of the discharge and the reaction set up. The therapeutical effects appear to depend more directly on the nature of the discharge-current, its potential and density, although they are to some extent affected by the type of apparatus employed, and certain details in the construction and adjustment of its various parts.

The Nature of the Discharge.—It is superfluous to mention that the reaction set up by a spark-discharge is greater in degree and less easily endured than that caused by

still-discharges. The revulsive effect of the former becomes more actively manifest as the session is continued, whilst an erythematous blush—first observed in the parts against which the discharge is directed—spreads out for an inch or more over the contiguous surface, to persist for a variable length of time after the termination of the session. When the body of the patient is a capacity actively electrified by its direct connection with the upper terminal of a resonator Oudin, or with the central spire of Reus' cones, or of Guilleminot's spirals, the nature of the reaction will, in a measure, depend on the nature of the discharge current. It must, however, be remembered that the spark-discharges of simple eductive effluvation are less ardent and painful than those that pass between the body and an active electrode in opposite states of electrification (*i.e.*, the bipolar method). Under the latter conditions, it is not infrequently noticed that a spasmodic anæmia of the skin, extending over an area of ½ to 1 inch in diameter about the part struck, is caused by the passage of a single spark. This pallor is accompanied by an erection of the papillæ of the skin, giving rise to the condition popularly described as "goose-flesh." This primary effect remains manifest for 3 or 4 minutes, after which it gives place to an erythematous redness, as strongly marked, but more persistent—lasting for several hours or even days, if the skin be particularly sensitive. If the duration of a session of treatment by sparks be unduly prolonged a true trophic necrosis of the cutis may be produced, for even under ordinary conditions a nasty ulcer is often seen in parts submitted to the action of the sparks. When the body of the patient is a neutral capacity subjected to a discharge of sparks, the same untoward effects may be manifest if the current employed be one of very high tension and density. It is true that the pain, which renders spark-discharges almost intolerable even to a healthy skin, can in a measure be mitigated by the substitution of a brush, a condenser or vacuum electrode for the single wire or ball-pointed one ; yet even then the reaction is often so excessive as to limit the sphere of application of spark-discharges. Treatment by effluvation therefore largely resolves itself into a matter of application of either the effluve, from a many pointed *impluvium* or rose electrode, or the delicate violet-coloured discharge of eucomides produced by the use of a condenser, water, or vacuum electrode.

The Character of the Flux.—In dealing with labile bipolar derivation (both continuous and interrupted), attention was directed to the current discharges, which give these methods of application their distinctive character. These peculiarities have also an effect on the local reaction, although the difference is one of degree rather than of kind, for radiations

only occur at points where intimate contact between electrode and skin fails. It may be said that the more continuous the flow of the current, the less in amount will be the erythema produced, whilst the more interrupted the flux, the more marked is the local reaction: *a fortiori*, a brush held a little distance away from the skin produces a more noticeable local effect than when moved more immediately over its surface.

The Tension of the Current.—It has been already said that the tension of the current has a decided influence upon the nature of the discharge, and so indirectly upon the effect produced. With a current of low potential, like that derived from the small solenoid or simple coil of high frequency, no effluve can be obtained, and even when a condenser or fluid electrode is employed, the slightest alteration in the relative distance between electrode and skin is sufficient to give rise to a discharge of bright glistening sparks in place of the more gentle eucomides. This is also the case when the opposite pole of the solenoid is earthed or connected with the patient. On the other hand, a current of high potential, like that derived from the central spire of Reus' cones, Guilleminot's spirals, or the upper terminal of a resonator Oudin, allows of a more extended limit for the graduation of the intensity of the current and control over the local reaction.

The Density of the Current.—The discharge, which takes place between two conducting bodies in opposite states of electrification, is more powerful in its effects than that which occurs between an active capacity and a neutral conductor. It is for this reason that the bipolar coil of high tension and a duplex resonator produce a more marked local and systemic reaction (*i.e.*, bipolar method) than when the current employed is derived from a single resonator; for not only is the tension of the current derived from each of the poles individually increased, but as they are of opposite sign their mutual attraction extends the limits between which control can be exercised over the local reaction.

(*To be continued.*)

LECTURES TO MEDICAL PRACTITIONERS ON PHYSICS APPLIED TO MEDICINE.

By Sir Oliver Lodge.

SUMMARY OF LECTURE IV.

SURGICAL AND MEDICAL APPLICATIONS OF RAYS.

(Continued from p. 209.)

Ultra-Violet Rays.—When a beam of light is passed obliquely through a prism formed of dense material it is bent out of its path, or refracted; and if the light be homogeneous, like sodium light, corresponding to a pure tone, that is all that happens; but if the light is of a complex nature, like ordinary daylight, corresponding to a multitude of notes sounded together, each component is refracted differently, so it is analysed into its constituents.

When a beam is analysed by a prism into a spectrum, the waves of different size, or, in other words, the oscillations of different frequency, are sorted out; the long waves, or comparatively slow frequency alternations, are all bent a little, and all bent alike, but the waves which are small enough to appreciate the size of the atoms, or heterogeneous elements of which matter is composed, become bent a little more; and the nearer the waves approach to the size of molecules, the more they are bent. Consequently, the short waves, roughly speaking, are at one end of the spectrum, and the long waves at the other.

The whole of these waves have physical energy or heating power; that is to say, when quenched by a black surface they generate heat. It is inexact to speak of them as "heat waves" or "radiant heat," except in the sense that they have the power of generating heat when absorbed. As long as they are waves in the ether they are truly "*radiation*," but not "heat"; heat exists only in matter, and is a quivering or other motion of the particles of matter, such as could naturally be excited by the impact of nerve, the sense of light with three distinct colour heat-generating power, and therefore this infra-red end of the spectrum is often called roughly the heat region.

Oscillations of a certain range of frequency have the power of stimulating the rods and cones in the retina and exciting in the brain, through the optic nerve, the sense of light with three distinct colour sensations. This physiological action is effected by a short intermediate region of the spectrum, which is therefore frequently roughly called the "light"

region, or the luminous or the visible spectrum. Physically there is nothing but difference of wave length or oscillation frequency, and if one can speak of "colour" in that sense, there is an infinite gradation of pure colour in a spectrum (though not by any means all the colours there are or the most interesting ones: nothing corresponding to chords in music, only pure tones). Physiologically, however, there are good reasons for asserting that the normal eye has definitely three, and only three, colour sensations (a particular shade of red, of green, and of violet), and that of these all our colour experience is composed; that a colour-blind eye may have two, or only one; and it is suspected that a few abnormal eyes have an indication of a fourth colour sensation, and are extra-sensitive to red—a sensation in which the commonest colour-blind eye is more or less deficient, though, of course, not aware of the nature of its deficiency.

Still more rapid vibrations in the spectrum synchronise more nearly with the periods of intra-molecular or atomic vibration, and accordingly are able to shake asunder unstable compounds, and produce chemical effects in suitable materials such as are spread on a photographic plate, and for this reason they are roughly spoken of as "chemical" or actinic rays. The chemical activity of the spectrum extends far beyond the visible portion to the extreme ultra-violet, but it overlaps the visible portion also, covering the region of the blue, and being very small indeed in the yellow and red; although it is possible to find certain salts– silver bromides and others—which can respond to the red or even to the infra-red; and some so-called "isochromatic" plates are intended to be equally sensitive throughout the spectrum—an intention, of course, only very partially fulfilled.

The strongest ultra-violet rays exist well beyond the visible spectrum, and can be made visible by exposing a "fluorescent" substance, that is to say a substance which, absorbing the high frequency vibrations, emits them at a lower frequency, so that when emitted they appeal to the eye with a sense of greenish light. The kind of substances now employed for X-ray screens serve this purpose very well, and were, in fact, used for that purpose before X-rays were by their aid discovered.

The separation or analysis of light into its constituent frequencies or wave lengths, by reason of the heterogeneity of the constitution of matter, is called "dispersion"; and from the amount of dispersion an estimate of the size of molecules can be made. But a complete theory of dispersion, such as that given mathematically by Helmholtz, Stokes, Kelvin, and other great mathematical physicists, showed that if wave lengths existed still smaller than molecules they would again tend to be treated all alike, just as they are when very

much bigger than molecules. Hence a theoretical completion of the ultra-violet spectrum involves a folding of the complete spectrum back upon itself, as it were, the highest frequencies being less and less bent, and finishing off by rays which would not be deviated at all, but would proceed, as Helmholtz said, unrefracted and comparatively unabsorbed by ordinary opaque matter; that is to say, infinitely short waves would go in straight lines and be very penetrating.

The subsequent accidental discovery by Röntgen of X-rays (by the action of a Crookes' tube on a fluorescent screen) brilliantly illustrated this mathematical theory of dispersion, for they behave precisely in this way.

The X-rays, however, are not to be thought of as a continuous chain of waves like light; they are ether pulses, but they are a discontinuous series of single pulses in enormous numbers—not like an organ peal, but like a constant succession of whip-cracks from a million energetic drivers. Somewhat the same sort of disturbances, on a larger scale, is employed for ordinary wireless telegraphy.

The whole of this theoretical spectrum is not to be experienced from any known source; it is possible that the sun may emit it, but we never get full sunlight unmitigated by some atmosphere, and that quenches much ultra-violet and all the X-rays, if there are any, for it is equivalent to 30 inches of mercury, or a yard and a half of lead. A low-temperature source, such as a flame or Swan lamp, gives no ultra-violet, and is feeble in blue; consequently the light is not quite white. A still lower-temperature source affects the eye with a sense of dull red; below that it only affects the general skin with a sense of warmth.

To get ultra-violet light, a high-temperature source is necessary; the chief sources being an arc-lamp, an electric spark, or a brush discharge. Sunlight contains much ultra-violet at the top of a mountain, and it contains some wherever air is clean, as at sea: clean water vapour not being very opaque to it. But the thinnest pall of smoke or other foreign material in the air cuts off the whole of the ultra-violet region, letting the heat rays through undisturbed, or even helping to entrap them. Hence sunlight in or near *towns* has very little chemical activity; it can affect sensitive photographic plates, but it is inadequate for bleaching or other chemical processes, and it does not bronze the skin or kill bacteria. Bronzing of the skin, though thought to be due to pure air, is really due to ultra-violet light, which that air does not stop, and which is reflected from snow or sea as well as received direct from the sun and sky and clouds. High up where the air is rarefied the action is so strong as to become blistering, unless time is given for pigment cells to develop, but a screen of glass will entirely absorb these blistering rays. A naked arc-lamp in a

greenhouse will wither the leaves of plants by its ultra-violet light, but a screen of glass will absorb the deleterious and let through the usefully active chlorophyll-stimulating rays, exerting the same influence that our atmosphere exerts on crude solar emission converting it into beneficent sunshine. If the shadow of a glass plate thrown by an arc-lamp fall half across a leaf, one half will remain green, and the other half will turn brown. The ultra-violet residue in country sunshine is entirely healthy, and produces effects often erroneously attributed to ozone.

An arc-lamp can produce bronzing of the skin and sunstroke effects. Eliminating the heat rays by water in a quartz vessel, the effect continues; eliminating the ultra-violet by a pane of glass, the effect ceases. Concentrated light must always be filtered through water or other suitably selecting opaque substance, before application, or it will burn by mere heat-production. The water will get warm and should circulate. It does not stop the ultra-violet rays much.

To concentrate extreme ultra-violet light, quartz or pebble lenses must be used—not glass—for quartz is very transparent to such rays, while glass is selectively opaque.

Differences and Similarities between X-rays and Ultra-Violet Rays.—Clear distinction must be drawn between the effects of X-rays and of ultra-violet rays. Both act on, and can be demonstrated by, a fluorescent screen; but whereas ultra-violet rays only affect it from the front, X-rays affect it equally from the back through the black paper or wooden or cardboard backing, and from that position are generally employed. Their electroscopic effects totally differ: ultra-violet rays act on surfaces, especially but not solely on clean metallic surfaces, causing them, when negatively charged, to throw their charge off. Hence therefore they cause a negatively charged electroscope to leak rapidly if it has a recently cleaned zinc terminal upon which they fall. In other words, atoms which have acquired an extra or supernumerary electron will, when jostled by ultra-violet waves, *i.e.*, waves of frequency not very different from some of their own natural periods of vibration, fling the extra electron off. Visible light has no such effect, consequently a pane of glass interposed completely stops the action. If the charge is positive instead of negative the action is also nearly suspended; and if the surface is dirty the action is much slower.

A slight residual action is found on most surfaces, such as leaves and rock surfaces, whether they be charged positively or negatively, and this is part of the cause of atmospheric electricity, but it is a small effect compared with the rapid leakage from negatively charged recently cut or scratched surfaces of metal.

Ionisation.—X-rays behave quite differently ; they cause an electroscope to leak violently, no matter whether it be positively or negatively charged, and no matter what its surface may be ; they do not act on surfaces but on the air : on that they act chemically, ionising it, breaking up its molecules into charged atoms, rendering it therefore a conductor or electrolyte, in which all charged bodies must rapidly lose their charge. The effect persists for a time after the X-rays have ceased, until the dissociated atoms have had time to re-combine into molecules and the air resume its normal condition. This property of "ionisation" must be the most important medical property possessed by X-rays. Unlike light, which can only act on unstable chemical compounds, X-rays seem able to shake asunder even stable molecules—the molecules of ordinary substances. For instance, they can produce a violet colour in manganese glass ; and can colour various salts. They strongly shake asunder the binary molecules of atmospheric oxygen and nitrogen, dissociating them into free ions, which may subsequently re-combine into oxides of nitrogen and into ozone, as well as their original simpler molecules. Radium rays can oxidise iodoform, turning a solution of it into chloroform deep brown by rays which have penetrated glass and mica. (Hardy and Willcock, "Proc. Roy. Soc.," vol. 72, p. 202.)

As regards cells of the body, they probably act most on active cells, where changes are occurring. I should expect them, therefore, to act more on the dermis than on the epidermis. It would be odd if they did not act on the hæmoglobin of the blood.

Bactericidal Action of Ultra-Violet Light.—Professor Marshall Ward's experiments on the effect of sunlight in killing the germs of anthrax, so that when subsequently incubated only the parts unexposed to light became covered with spores, are described in the "Philosophical Transactions of the Royal Society," vol. 185 (1894), B, pp. 961-986.

At Liverpool I conducted some experiments for him with an electric arc spectrum formed by quartz lenses and prisms. An open flat glass vessel closed by a quartz lid was filled with agar jelly containing anthrax. The whole was swathed in black paper and tinfoil, except for apertures through which the spectrum could be thrown on to the quartz lid. I gave an exposure of many hours, taking care that the ultra-violet region as well as the visible region should fall on the plate. The plates prepared by Professor Marshall Ward were subsequently incubated and examined by him ; and the slaughter of the germs was found to be complete in the ultra-violet region, especially in certain parts of it, the action shading off into the violet of the visible spectrum, and fading away also

at the other end, possibly from mere dilution of the rays. In every way the bactericidal action of ultra-violet light was proved.

No such action has been proved for X-rays, which are found to have rather a stimulating action than otherwise, and by some it is suspected that if they kill bacilli at all in a living body it is an indirect action due to the stimulation of phagocytes.

Ultra-violet of the bactericidal kind is also the deleterious kind for healthy tissue; hence in applying it it is essential to localise it to diseased parts, which may by it be destroyed; and the healthy parts may subsequently perhaps be assisted to grow by a suitable application of X-rays carefully freed from deleterious concomitants. It is important to realise that since ultra-violet rays are invisible they may be found where least expected, and they are fairly plentiful in all electrical glows and effluvium of sparks, and in over-energised X-ray bulbs, as well as in the high frequency and other brush discharges, of which I speak next week.

To exhibit the fact that ultra-violet light occurs in a spark, I show a spark between iron electrodes discharging negatively electrified zinc; and I also show the influence of one spark upon another; for if a couple of spark knobs be set so that a spark is just unable to jump between them, a spark will be precipitated under certain conditions when the light of another spark falls on the gap. If a pane of glass is interposed the action ceases; but if a pane of quartz is similarly interposed the action continues, as if the quartz were not there; proving that it is not the effluvium or other material carried from one spark to the other, but the agency of invisible ultra-violet rays. Radium rays have the same effect, still more strongly.

If a patient on an insulating stand were charged negatively and then a patch of his body acted upon by ultra-violet rays, that patch would discharge negative electricity. If acted upon by X-rays, or radium rays, it would discharge electricity whichever way the patient was charged. This discharging action from a given area of an insulated and charged patient is not to be overlooked, both as to a possible therapeutic influence and as to the production of X-ray burns. So also must attention be paid to any ultra-violet accompaniment.

Extracts from letter by M. M. Sharpe (*Archives of the Röntgen Ray*, January, 1901, p. 50):—

"In the early part of this year I had four cases under treatment—one psoriasis, two lupus, and one epilation. I was using a 12-in. coil on the 100-volt alternating circuit, with a Caldwell electrolytic break. My tube was never under 6-in. spark, and towards the end had gone up to 7·5 in. The

cases had all been under treatment several weeks, were making satisfactory progress, and had shown no signs of dermatitis. They all showed the characteristic brown staining. When the vacuum of the tube had got so high that I had difficulty in getting the current across, I changed it for one with a spark length of 4 in., giving very much less green rays and a visible stream of violet rays from the cathode. Within ten days every one of the cases had dermatitis. There can be no doubt that it was caused by the comparatively low vacuum of the tube, as the details of the operation were not changed in any other respect.

For successful treatment of a "port wine stain" by X-rays in Germany, see *Archives*, January, 1901, p. 51; apparently by only one or two exposures at intervals of a month, each continued "until a strip of sound skin showed symptoms of hyperæmia." In two months the sore healed, in two years the skin was normal.

Finsen Treatment.—The application of heat rays to healthy skin is carried out in the Dowsing system of treatment. The application of ultra-violet rays to superficial diseases, such as lupus, was made by Finsen, of Copenhagen, who also examined into, and has made statements concerning the action of visible light of different colours; especially on the effect of completely excluding *all* the chemical rays, even those at the blue end of the visible spectrum, from threatening suppurations.

In making quotations of results claimed, as before, I quote for convenience only and without responsibility; but Finsen has now been recognised by the University of Edinburgh and other authorities, and the ultra-violet treatment has been well tested in this country also, so that I assume his statements to be of importance. They may possibly suggest a mode of treating accidentally-caused X-ray burns.

The following statements are made by Finsen concerning the action of light upon the skin:—

"Small-pox patients kept in rooms with red glass windows get well without scars, and the vesicles do not suppurate. Daylight, and especially the chemical rays, have a most injurious effect on the course of small-pox, and the suppuration of the vesicles is due to the effect of light. In Denmark the public hospitals for infectious diseases are provided with permanent red-light wards for small-pox patients. For treatment of small-pox, the exclusion of chemical rays must be absolute, and red photographic glass is best. Blood is very opaque to the chemical rays, and hence it must be expelled by pressure, from the region to which the ultra-violet treatment is to be applied. Bacillus prodigiosus can be killed

in one minute by chemical rays, and lupus is much benefited by them. The epithelium is transparent to ultra-violet rays, but blood-filled capillaries stop them."

Sir James Crichton Browne asserted at the Midland Institute recently that different coloured lights have an influence on mental conditions—that red light excites, while blue depresses. He also says that ample testimony has been accumulated as to the value of the light cure in lupus, in fungoid diseases of the skin, and in those kinds of cancer known as rodent ulcer.

A full and illustrated account of the ultra-violet system of treatment is given by Dr. Valdemar Bie, of the Copenhagen Finsen Institute, in the *B.M.J.* for September 30th, 1899.

There are also papers on the subject, with illustrations, in the *B.M.J.* for 6th June, 1903, and the effects of the Finsen treatment are there compared with the effects of X-ray treatment.

I would also refer again to the quotations at the end of summary of my Lecture III; and in continuation of those on p. 9, would call attention to the correspondence columns of to-day's *Nature* (25th February, 1904) on the subject of possible parthenogenetic development under certain stimuli, and of the possible sexual character of the cell development in cancer.

FLUORESCENT TRANSILLUMINATION OF OUR STOMACH.—H. W. Lincoln states that he finds fluorescent transillumination satisfactory. He has had it in a number of instances, according to the method of Kemp, who introduced the method in October, 1903. It may be used in stout as well as thin persons with good results and even with the coloured race the results are fair. Technique: Give the patient 10 grains or more of quinine the day of examination or the day previous. When quite ready, introduce the lamp; have the patient drink a glass of water into which has been dissolved 30 to 40 grains of sodium bicarbonate, to render the gastric contents alkaline. Allow another glass of water to be taken, into which has been placed $\frac{1}{8}$ grain of fluorescin, one dram of glycerine and 20 grains or more of sodium bicarbonate. The abdomen being bared, the patient is conducted into a dark room, or if at night the lights are turned out, when the examination can be made. Because of the danger of inducing vomiting by the introduction of the lamp, Lincoln finds it best to introduce it prior to the administration of the fluorescent solution.—*New York Medical Record*, April 23rd, 1904.

DIGEST OF AMERICAN LITERATURE.

RÖNTGEN RAYS AND RADIUM RAYS.

Williams, in a study of the comparative value of these two agents, in the several ways they are used in medicine, concludes as follows :—(1) The rays from radium salts, unlike the Röntgen rays, are not serviceable in diagnosis, either by means of a skiagraph or of a fluorscopic examination ; (2) The beta rays are useful in certain skin diseases and new growths, if the diseased tissues are superficial or are not more than 1·25 cm., or one-half inch below the surface of the skin or the mucous membrane ; (3) The beta rays from radium salts will heal some cases of new growths that are not healed by the Röntgen rays, and they act more promptly, but not over so large a surface at one time as the Röntgen rays; (4) Radium salts of 8,000 radio-activity or considerably more, are of little, if any, avail. Pure radium salts of 1,500,000 radio-activity are not too strong for the work to be done ; (5) The radiation from radium salts, unlike that from the Röntgen ray tube, is uniform ; (6) Great care should be exercised in order to avoid burns.—*Boston Medical and Surgical Journal*, Feb. 25th, 1904.

Remark.—This seems to be the consensus of opinion. The lower radio-activities are useless in malignant, as well as in long standing and deep-seated pathologies. In more recent superficial and foreign conditions, they are not inert. Two cases of anal fissure, one healed promptly in from two to three exposures of from five to 10 minutes from exposures to the beta rays, of a 7,000 radio-activity, and are now respectively well after three and four months. One had been referred for operation after classical treatment of two months' duration, but was unwilling to undergo it, and came to the writer for electrical treatment. The other had not been treated at all. It is interesting to note that the same result has been obtained in the writer's experience from the magneto-induced current, secondary, wire of 1,500 turns, also from the sinusoidal current, and likewise from currents of high frequency. With the first two currents, the applications were recto-abdominal or rectal bipolar. With the latter a monopolar application only is made. The cure was more quickly accomplished by the use of the radium than by the alternating and high frequency currents.—(AM. ED.)

* * *

TWO CASES OF RÖNTGEN-RAY NECROSIS, PRESENTING SOME UNUSUAL FEATURES.—Clarence E. Skinner reports two instances in which pronounced necrosis and sloughing of tissue occurred long after a prolonged use of the X-rays. In the first case the noticeable features were : (1) depth to which the original necrotic process extended ; (2) "tanning" and excessive proliferation in spots of epithelium of the new skin that was exposed by the peeling of that which has been browned directly by the ray ; (3) cessation of the pain so soon as the necrotic tissue had separated ; (4) favourable effect of the galvanic current in hastening the healing process after necrotic tissue had sloughed ; (5) appearance

of an area of necrosis five months after the last Röntgen-ray application in a region which had previously exhibited no evidences that such injury had been inflicted. In the second case, the most marked feature was the appearance of an area of necrosis six months after the last Röntgen-ray application, in a region which had never before exhibited any evidence of injury. In the history of these two cases Skinner finds a warning against the exposure of patients for long periods of time to the Röntgen-ray applications, even with a moderate degree of frequency, no matter how well they seem to be borne. —*Medical News*, Feb. 20th, 1904.

(Cases similar to the above in connection with Pilkins' exhaustive report of dangers to the operator from the X-ray constitute a warning against the over-zealous use of this agent. From the destructive and atrophic changes established by its use it is only reasonable that the longer slower vibrations of the continuous current should influence favourably nutritive changes. This is true in other atrophic conditions, in so far as there remain undestroyed cells to act upon. In optic atrophy, for example, with total blindness the writer has secured by its use: (1) response to the current; (2) sensation of colour; (3) ability to distinguish day from night and the position of windows; (4) to distinguish the sun; and (5) to see the lightning.—AM. ED.)

* * *

LIGHT.—Gottheil, in a recent contribution to this subject, uses the term actinotherapy to apply to light therapy when the violet and ultra-violet frequencies are used; phototherapy, on the other hand, to include all kinds of light treatment. His actinotherapy includes concentrated sunlight and the various forms of the electric arc, as light from incandescent bulbs is of feeble active power and penetration. The characteristic action of the chemical frequencies upon bacteria and the circulation are invariable, a distinct endo-vasculitis resulting after a time, followed by atrophy. The stimulation of oxidation and connective tissue formation are numbered among the remoter effects. The tissue changes are moderate and controlable, they are rapidly induced, and are without remote effects. In lupus vulgaris, tuberculosis verrucosa cutis, tuberculous ulcer, post-mortem tubercle, it is the most effective treatment. In these conditions the cicatrix is often hardly apparent. The showing in lupus erythematosus is encouraging; while satisfactory results have been obtained in alopecia areata, birthmarks, carcinoma, epithelioma, rodent ulcer, Pagets' disease, acne rosacea, and parasitic skin diseases. It has been recommended in hay-fever and tuberculosis.—*Journal of the Am. Med. Ass.*, March 19th, 1904.

Remark.—The multiplication of terms is always unfortunate, and as all the frequencies, even to the red, are, to a degree, chemically active, it seems unwise to use a term implying chemical activity, and then limiting the action to the violet and ultra-violet frequencies alone, even though they are the most active. Where all frequencies, save those of the ultra-violet region, are excluded, the method should be known as that of ultra-violet light, for although invisible as light to the eye, the limitation is in the eye itself. For the use of the blue, indigo, violet and ultra-violet

frequencies, the comprehensive term of blue light seems unobjectionable; for the exclusion of all save the frequencies of the red region, red light; while for the radiant energies of light, the term light added to the source of energy, viz., sunlight, arc light, and incandescent light. Now the physician, whose medical knowledge is superior to his physical knowledge, becomes hopelessly entangled in the mesh of actinic light, Finsen rays, ultra-violet rays and phototherapy. They are quite as jumbled in his mind as in the sentence preceding. To many, a Finsen ray is some occult radiation like unto, or as mysterious as, the X-ray. It detracts nothing from the honour due Finsen, to protest against the handing down of his name as an attachment to a part of the spectrum known and named in relation to other parts, long before Finsen's comprehensive work. Only now is the medical profession shaking off the name of Galvani, as applied to a continuous current. Had the ultra-violet frequencies been discovered by Finsen, or the voltaic pile by Galvani, the reason for the use of the one or the other name in connection with the observed phenomena would not have been objectionable. In establishing the nomenclature of light therapy, it would be well to profit by the mistakes of electrotherapy, for example, and avoid the use of "localisms."—THE AMERICAN ED.

CORRESPONDENCE.

To the Editor of *Medical Electrology and Radiology.*

DEAR SIR,

In the discussion that followed the reading of Dr. Horace Manders' paper on "The Choice of Method in the Therapeusis of High Frequency Currents," *vide* Part II, some members, in criticising the newer nomenclature in the Journal, appear to be under the impression that the word "session" had been brought forward to supplant "application." This idea is wholly erroneous, the expression being used as the exact English equivalent of the French "*séance.*" It is also incorrect to assume that the term indicates "a period of time" rather than "the actual work done," as its classical meaning is "a sitting; the business or work accomplished at a sitting."* The exact difference between the terms, "session" and "application," can be readily understood, if it is remembered that a single session may consist of several different applications—for instance, it may comprise an application of high frequency electricity by derivation method, followed by one of galvanic cataphoresis.—C. A. WRIGHT.

* Hooker, in his *Eccles. Polity,* speaks of "Christ's *session* at the right hand of God." Burnet, in the *Records* (pt. ii, bk. i, No. 56), says: "The said Lord President and Council shall keep four general sittings, or *sessions,* in the year." Again, in Smith's *Commonwealth* (bk. ii, ch. iii), we read: "But the last day of that parliament, or *session,* the prince cometh in person," etc. In these examples of its use, no idea of time is involved but one of active operation, the work accomplished being that of "perpetual intercession," "administration of justice," and "the making of laws" respectively.

PART II.

PROCEEDINGS OF THE BRITISH ELECTROTHERAPEUTIC SOCIETY.

Edited by CHISHOLM WILLIAMS, F.R.C.S., Ed.

MAY 27th, 1904.

The Twenty-second Ordinary Meeting was held at 11, Chandos Street, Cavendish Square, W. The President, Dr. LEWIS JONES, occupied the Chair.

Present:—16 members and two visitors.

The following were duly elected:—Leonard C. Dobson, M.D., and John Atkins, F.R.C.S., of 59, Addison Gardens, Kensington, W.

Dr. G. H. GRAHAM showed an interesting case of congenital deformity of left arm and left side of head.

R. W., a woman aged 32. The case shown is one of congenital malformation of the first left branchial cleft, with absence of the ear and of the 7th and 8th cranial nerves, and congenital deformity of the left arm. The family history shows no tendency to any malformations. Patient's father and mother and the family of two brothers and three sisters were all well developed. Patient comes second in the family, the first child having died two days after birth.

There is considerable asymmetry of the face. Portions of the external ear are present, and an accessory auriel, but there is a deep depression between the mastoid process and the ramus of the jaw. The tympanum is absent. The Eustachian tube is patent for some distance. There is no sense of taste on the left side of the tongue, which is not so well developed as on the right. She cannot distinguish odours as well with the left nostril as the right, and vision with the left eye is very defective.

Patient states that she has had a full number of well-developed teeth in both jaws, but now wears artificial sets, both upper and lower.

The skiagram shows the condition of the arm, but both the scapula and clavicle are less than half the size of the corresponding ones on the normal side. The radius and the radial side of the wrist and hand are absent. There are only two well-formed fingers, but these are most useful to her for sewing and all other occupations. Owing to the peculiar bony formation, stimulation by an interrupted current of all the muscles on both the anterior and posterior surfaces of the forearm causes flexion of the wrist.

The skiagram shows the palmar surface and inside of the arm, and was taken with a 12-inch coil, and 15 seconds' exposure given.

I am indebted to Mr. R. P. Rowlands for allowing me to show this case.

"A Case of Appendix Sinus Successfully Treated with Electricity," by ALFRED W. SIKES, M.D., B.Sc.(Lond.), F.R.C.S., M.R.C.P.

I think that the following case will be of interest to the members of the Society. One often hears of and sees cases of non-tubercular sinus which have for months and even years resisted all the well-known methods of treatment, and I think that anything which will relieve or cure these cases should be made known.

The patient whose case I am about to describe is a young man about 24 years of age. I first saw him in consultation in March, 1904, with Dr. Gregory, of Redcliffe Gardens, who has kindly supplied me with the details of the following history.

The patient was operated on in July, 1903, he had previously been ill about a week; a large abscess was opened in front and a counter-incision was made behind. The case went on very well till the third week, then the temperature went up. On examination of the wound two deep catgut stitches were removed, after this the temperature fell. Both sinuses remained patent till Christmas, 1903, then a firm pad was applied, with the result that the posterior one closed soon afterwards; some time after the anterior one closed, but a little later had to be opened and pus evacuated. There was not much change then till March, when I saw the case.

The usual surgical treatment had been used throughout, the wound was syringed out with antiseptics, a rubber tube being employed to keep it open, and cyanide gauze kept on the opening under a belt.

I must admit that with this history and the condition described below I could not promise the patient anything, but a few days later he wrote saying he had decided to give the treatment a trial; the sinus was a source of such continual worry to him that he was anxious to try anything which held out a possibility of success.

The treatment was commenced on March 7th, 1904. The form of electricity used was that derived from the top of an Oudin-Dean resonator, the coil supplying the resonator being one giving a 12-in. spark. The method of application varied as the sinus improved, at first glass tubes filled with water were used of a size to fit the sinus, a wire was lead to the bottom, and the current was just strong enough to cause slight sparking all along the tube. At the commencement I also used a tube through the bottom of which a thick wire projected to the extent of about ⅛ in., so as to get the chief effect at the bottom of the sinus, and to try to get it to heal up from here. Later, as the sinus got too small to admit any water tube, a simple wire or probe was passed to the bottom, and the current applied through this; one did not treat the

inside of the sinus in these ways for long at any one time, as there was sometimes a very definite reaction set up. On every occasion the effluve was also used at a distance just great enough to prevent sparking on to the surface of the abdomen.

Condition of the Sinus when the Treatment was Begun.— The sinus was about 1¾ ins. deep, and the opening was situated rather above the line between the umbilicus and the spine of the ilium; from this point it went backwards and slightly outwards through the muscular layer of the abdomen into a mass of fibrous tissue on its deeper side, the outlet was about ⅜ in. in diameter, and when a director was passed there seemed to be a slight bridge caused by the muscular layer, and below this a slight expansion; the edges all the way down were hard, fibrous and callous, it was not tender except at one point at the "bridge," and did not bleed unless roughly handled. There was at every dressing a small quantity of pus.

Examining with the two hands, a mass of fibrous tissue could be felt extending about ½ in. deeper than the probe would reach, there was nothing in the way of a concretion to be felt, and no possibility of any remaining stitch. In the lumbar region there was the scar of a counter-incision which had been made, but which had completely closed. Here the fibrous tissue was superficial, and I could not trace any band of hardened tissue connecting the two parts.

At first, before and after an application of electricity, the sinus was washed out with some solution of chlorinated soda or carbolic, but later on as it became smaller one could not even do this, and electricity was the only agent used. An attempt was made on two occasions to stimulate the sides by means of a sharp probe. At first some cyanide gauze was used as a drain through a small rubber tube, but later I found it better to use only a rubber tube or spiral wire tube at the opening.

At first the case was seen three times a week, but later shorter applications were given, and more frequently.

The improvement in the first week was very marked, the sinus had shortened about half an inch, there was much less pus and it seemed in a fair way to heal in a week or two, then one day I noticed that it had gone back. There was a little more pus, and so far as I could make out on enquiry, this was due to the unboiled tube having been put in since I had last seen the patient. I think that this put back the cure of the case at least a week.

After this set-back the case went on again very well, and after about four and a half weeks the sinus had completely healed up. One part of the effect of the electricity I was quite unprepared for, it seemed to cause a certain contraction

of the fibrous tissue, as even when the patient was lying perfectly still and the current was applied either directly or in the form of "effluve," there was caused some oozing of fluid from the wound. With regard to the method of acting as applied through the water tube, I believe it acts as a stimulant to the side of the sinus, the ozone which is formed also helping, then the tissues round are directly stimulated with contraction, increased blood supply and cell formation.

I cannot find any literature on the subject of the treatment of non-tubercular sinuses in this way, although many papers have been written on the healing of superficial ulcers and on the effect of electrical treatment on tubercular conditions.

The President, Dr. LEWIS JONES, compared the results detailed by Dr. Sikes with some which have been published on the treatment of sinuses by X-rays with a metal probe inserted in the sinus. He thought Dr. Sikes' cases made it probable that the results obtained in that way owed their success to electrical currents set up in the probe by the X-ray discharges.

Dr. G. B. BATTEN related a case of tubercular sinuses in a child's arm, treated three years ago in much the same way as Dr. Sikes describes, with a wire in a glass tube passed into the sinuses, and also by actual contact by metal electrode outside on the skin. Considerable healing followed.

Mr. CHISHOLM WILLIAMS remarked that the first case in which he had tried the effects of high frequency currents was a similar one to that described by Dr. Sikes, but was of a tuberculous nature. The lad had had his right hip-joint excised for tubercular disease of that part four years previously, but it had never healed thoroughly, leaving always two sinuses. Four operations had been performed for their relief, but with little curative result. Surgically speaking, the case was a failure. He used a special thin vulcanite covered electrode, and inserted 4 inches in one sinus, and nearly 3¼ inches in the other. The most interesting phenomena was the discharge from the sinuses after applications becoming as a thin clear serous fluid. They healed perfectly with 23 applications, each of about 15 minutes' duration. He had had several cases since then, and the power of high frequency used in this way to heal sinuses was very remarkable.

Dr. HORACE MANDERS read his paper on "The Choice of Method in the Therapeusis of High Frequency Currents."

Mr. President and Gentlemen,—In the Presidential Address, delivered at the January meeting of the British Electrotherapeutic Society in 1903, the following questions were propounded:—(1) "What then is the place of high frequency currents in present day therapeutics?" (2) "What are the claims?" And (3) "How far are they established?"

These questions were proposed to us of this Society for

solution 15 months ago, but, so far as I have been able to gather, there has been amongst us no systematic effort to find a solution ; and to the first question, " What is the place of high frequency currents in present day therapeutics?" I am afraid that the answer must be—as the currents themselves are—*Oscillatory!*—that is to say between those, on the one hand, who can see no further good in them than the cure of diseases, which exist chiefly in the imagination of the patients, by the mysterious fascination of the glowing Geissler tubes ; and those, on the other hand,—" gobemouches "—who seem to have the idea that the magic name of high frequency, whatever the mode of production or application employed, will cause tuberculosis, diabetes, and cancer itself, to cease their deadly work and slink away abashed.

To the second question : " What are the claims?" the answer will not now be "*Legion*," as it would have been when first demanded, but it will still be "*Manifold*."

To the solution of the third question : " How far are they established?"—this paper, which I have the honour of reading before you to-night, is a modest attempt, by provoking a discussion, which I hope will ensue at its close, among the experts present here.

Gentlemen ! It took a good many years of hard study and earnest effort in experiment before physicians, practising the treatment of disease by electricity, were able to assign to their proper place in therapeusis the Franklinic, the Galvanic, and the Faradaic currents. Therefore we must not be unduly blamed if, at the end of a very few years indeed after its discovery, we have not yet been able to make anything like a complete exposition of the intricacies of the treatment of diseases by electricity in oscillation ; a subject described by Sir Oliver Lodge as " the most abstruse and difficult portion of electrical science, dealing with undulatory disturbances and phenomena."

At the same time, I opine that it is the duty of us who have joined together to form the British Electrotherapeutic Society to collate the knowledge gained by the individual work of its members, if possible to formulate laws that all may safely follow, and to offer hints and suggestions to those who have the inclination and the leisure to continue the study, also to guide others in their practice, which would thus be rendered less empirical, more interesting, and encouraging. I cannot help thinking that, whereas we have been fairly communicative in detailing the cases and class of cases benefited by high frequency treatment, we have been reticent in stating the exact mode of application adopted in each case, and somewhat chary in promulgating the reasons which have guided us in choosing such and such a method, rather than any other, in any given case. We have been

content to rely too much upon the original statements of d'Arsonval and Apostoli concerning the physiological effects of oscillatory currents of electricity; correct enough, but far too general to satisfy us now: hence we have, each of us, probably acquired our own knack of application, or our own predilection of method, as the outcome of our own individual experience, but without even ourselves knowing exactly—WHY?

Now! All this is not quite so scientific as the importance of the subject demands. It does not enable the individual worker to treat a second case exactly as the first and so compare results, nor does it offer any basis upon which any other observer may work on parallel lines for control, check, or comparison. I must say, however, that I very deeply appreciate the most excellent article now running through the numbers of our journal, from the pen of our Associate Editor, "On the Methods of Application of High Frequency Currents"; and I am sure that I carry with me the sentiments of those studying the subject, in saying that it is the best and clearest explication of technical detail that has yet appeared; that it will be welcomed by the expert, and hailed by the novice as a solid basis upon which to work.

It has been said by a great master that "science is measurement." I will, therefore, put before you certain electrical measurements, which I have made under varying conditions of patient, and dispositions of circuit. Where I cannot express measurements by representative words, I will endeavour to do so by simple explanation.

As a commencement, and in order to render clear some of the argument which follows, I am afraid that I must ask you to accompany me over the description of the phenomena attending the discharge of a condenser, or rather, the discharge of the electricity induced on the outer armatures of *two* condensers. In the diagram before you, let A and B represent two condensers of a certain capacity (symmetrical), the outer armatures of which are connected by a wire W N M of a certain corresponding inductance. The inner armatures are connected to a source of electricity at a high potential now in action, and at the present moment the condensers are charged to their full capacity. There is the fullest stress that it can bear upon the air dielectric between the two dischargers.

The theory of the condition is this: That tubes of force are stretching in all directions; some from the discharging ball of A to that of B; others, long ones, from these balls to neighbouring conductors—walls, people near, ceiling, etc.; others again, short ones; these, the majority, will pass directly from the inner to the outer armatures; the shortest of all, right through the glass dielectric. Let us now take for investigation two of these, X and Z, one from each condenser,

which start from the dischargers of the inner armatures to the edge of the tinfoil of the outer armatures.

The stress on the dielectric between the dischargers has now become so great that it breaks down; a spark passes, and the space between the dischargers has become for the time being a conductor. In consequence of this, the tubes of force lying in this space shrink to such tiny dimensions that they do not now repel their neighbours, which are enabled, by this shrinking, to crowd into the vacated space, so that the tubes X and Z under consideration now occupy a position as depicted in the diagram No. 2. As these tubes are of opposite sign (as shown by the colours), there is a mutual attraction which impels them towards each other until they meet, as in diagram No. 3.

The instant they do so they split up into two portions (diagram 4), the upper one running up into the spark gap, where it shrinks to molecular dimensions, as did the others mentioned, and the lower one running downwards towards the wire connecting the outer armatures of the two condensers (diagram 5). The tube continues to travel down the armatures and then proceeds along the wire connecting them (diagram 6) until the two ends meet at a point in it (N), equidistant from each condenser. At this point the inertia of the tube will carry its ends past each other (diagram 7). These ends continue their course and approach the tube of opposite sign, which was emitted from the spark gap. The tubes then go through the process just described, but in the *reversed* order. When this is completed, one complete swing or oscillation has been effected. I need not follow the process further on to the complete equalisation of charge. My object is to point out the normal crossing point of the ends of the tubes of force, that is to say the place where waves starting from opposite points of a symmetrical circuit must interfere with each other. It is a dead point: there is no movement here, but great concentration. Such a point in a vibrating medium is termed a NODE. On the other hand, it is at the extremities of the wire, whence the waves start, that the amplitude of vibration is greatest. These points are called ANTINODES. In the dispositions of circuit and condenser I have adopted, the wave length of an oscillation is twice the length of the wire.

Hitherto I have represented the wire connecting the armatures as enclosing a large field, but as this is inconvenient in practice, on account of its length, we usually coil it up into a solenoid and magnetise a smaller space more strongly, by passing the current many times round it, which comes to much the same thing, not quite.

It is thus that we have d'Arsonval's coil intercalated in Morton's current. Upon this coil and at a point upon one,

its loops, which would be the centre point N if its loops were straightened out, exists the node.

For over two years I held the following theory which I mention now, partly because of the historical interest it now holds for me, partly in order to save your time in case the same idea should occur to any of my confrères. The theory is founded on the vibrations set up in a spiral fixed at one end and open at the other. I was led to this theory as a corollary to the one which I have already given you and which is due to J. Thomson. The further theory is that, as it had been noted that a considerable increase in the spark occurred when one end of the solenoid was connected to earth, the probability was that the earth being always reckoned in electricity as zero, an artificial node was established; say at the point W in diagram 7: the analogy seemed perfect; and nodes and artificial nodes became household words. It seemed reasonable to suppose that the increased spark was due to the red end of the tube of force being obliged to come right across to the point W before the blue end could start, and that the red could not start on its return journey until the blue had made its swing forward and back to W. In this case, the wave-length of the oscillation would have been four times the length of the wire.

My Confrères! My theory—my little first-born theory is dead: killed by the milliampère-meter. How fascinating it would have been had we been able to create an artificial node at any point of the solenoid, and so cause the waves in the shunt circuit to interfere in a corresponding part of the human body, and fix our intersection in any part of it, wherever the disease might be.

The milliampère-meter settled all that. I fixed it on the earthed wire during a series of experiments I was carrying out on the relative measurements of various methods of application, and in every case except those in which the earthed wire was placed on the true node at N, a certain amount of current was recorded—50, 60, 160, 210; it was unaccountable. I mentioned the discovery to Mr. A. W. Sharman, with whom I have done a great deal of experimental work and who had shared with me the nodal theory, and found that he had discovered the same phenomenon: he offered the explanation that a high frequency machine creates a dense field in the earth around so that it is no longer a zero; also, that the increase-spark at one end, when the other is earthed, is merely a bipolar effect. On thinking it out, I agree with him and feel that the action of a powerful high frequency machine must act on the earth within its influence very much as does a thunderstorm cloud.

In a former lecture, I showed that the effect of the intercalation of the human body within Morton's circuit is to

inhibit the oscillatory character of the discharge, whether a solenoid be placed on one side of it or on both. Now! this is by no means the case when the main discharge is allowed to flow through a solenoid or impedence coil, and the human body is merely placed in a side track or shunt circuit: the oscillatory character in this case is maintained both through the direct circuit and also through the shunt.

Instead of placing a patient in the shunt circuit, he may be enclosed within the impedence coil, which is made big enough to receive him. Being thus placed in the space through which lines of force are constantly oscillating, he becomes saturated with them, and gentle oscillating currents pervade his system. For some reason or other this has been termed auto-conduction; why? I can't imagine! for there is no *auto* about it; the patient himself causes no current of any kind within himself. There is no *conduction*. It is a secondary *induced* current; the first being that between the two outer armatures.

The physiological effect of these induced currents is that of a gentle systemic stimulation. The patient feels little or nothing, perhaps some surface heat, perhaps a little flushing of the face; it may be a faint giddiness or fulness of the head—all of which symptoms are due to rise of blood pressure. There can be no doubt that all emonctory organs are stimulated, there is more carbonic acid from the lungs, more transpiration of effete products from the skin, and finally both a larger quantity of fluid excreted by the kidney, and an increased percentage of urea. In regard to the larger quantity of urine passed, there is one thing I should like to mention, as it has repeatedly occurred in my practice, but I have not seen it recorded by others, perhaps because patients have not liked to mention it. The phenomenon is that the urine is occasionally discharged involuntarily during sleep in the night following the treatment. This has occurred, to their great distress, to people to whom such a thing had never happened before. In making enquiries as to a patient's history since treatment, and the patient seems a little bit shy, I usually find that the shyness is due to this having happened. I rather fancy that treatment by secondary induction within the large solenoid had somewhat gone out of fashion, yet it has a distinct value of its own. It is certainly the treatment for all chronic conditions associated with weak heart. It is most valuable as the commencement of high frequency treatment as a preliminary to local treatment. Glycosuria, anæmia, especially with amenorrhæa, chronic rheumatism, general or systemic gout, lithiasis, copræmia, and some forms of arthritis, are all benefited by this treatment. The currents thus set up within the economy appear to have the effect of causing it to respond to remedies, which previously to this

form of high frequency treatment had not produced the results expected of them from their internal administration.

The duration of session should not be too long, especially in the case of those in whom headache is apt to ensue, as this is often persistent. Ten minutes is enough to begin with. The best hour for treatment—and this applies to all high frequency applications—is previous to a meal, after which it is better for the patient to rest for a little.

It will be found a very good plan to register the blood pressure both before and after the session, as this is about the only definite means of measurement we can employ to gauge the effect on the patient.

From treatment within the field of the solenoid, I must pass on to that of the shunt circuit in Morton's current. This shunt may be used either as an open or a closed circuit.

THE OPEN CIRCUIT.—This gives us there varieties of application, which have been termed unipolar or monopolar, but surely the terminology is wrong. In dealing with and speaking of electricity or magnetism, the term "pole" has a definite meaning. There is a positive pole and a negative pole, a north pole and a south pole; but in oscillatory currents there is no such thing as polarity, unless one would call the positive pole that end of the solenoid nearest to the armature which receives the first induced positive charge; that is to say the one belonging to the condenser which is attached by its inner armature to the negative discharge pillar of the coil, a point of little practical value. It is nonsense to speak of a patient attached to one end of the solenoid, as undergoing a uni or monopolar treatment. Monoterminal fits the condition much better.

By "open circuit," we mean the circuit is not completed by a conductor in direct continuation; yet it completed somehow, either through the air or through the earth. Hence we may divide the monoterminal application into Aerial and Terrestrial:

(1) *Aerial.*—The patient is attached by means of a covered flexible wire (I usually work with one of a size known technically as 70 forties) to one end of the solenoid, say at the point M; *i.e.*, at an antinode in the circuit.

With a patient thus in an open shunt, it is by no means easy to say how the tubes of force are now acting. It occurs to me that there are two ways in which they might do so: the first is—the red end of the tube, which is travelling down the armatures, when it arrives at the point M descends the shunt wire to the body instead of continuing straight on. The blue end leaves the main circuit also, and proceeds through the air towards the body of the patient until it meets the red end, either within the body or outside of it, wherever the centre of the circuit or node may be.

The second way in which the ends of the tubes might cross is—the red end passes down the shunt wire into the patient, traverses his body in a more or less direct line (according to the electrolytic resistance it meets therein), and emerges into the air, finally arriving at the point W, and on to the armature. In the meantime the blue end has descended the wire from W to M (fig. 8). On the return journey matters are exactly reversed, and it is now the red end which descends the wire from the point W, and the blue end which traverses the body. The body is thus traversed by alternate currents of different sign. I rather incline to the latter theory, as being more likely than the other to account for the extraordinary fact and phenomenon that oscillatory currents do actually traverse a medium of such impedence as that of the human body when placed in a shunt circuit; whereas, if the same impedence is placed in a direct circuit, oscillations are stopped and the whole character of the discharge.

I have been tracing out the behaviour of only one tube of force, but of course there are any number of them—millions—and the body is pervaded with as many of them as can come down the wire, on the one hand, and can find their way through the air, on the other: unquestionably the body only gets a small proportion of them, in this mode of application. Those which enter the body are dispersed along the different lines of least resistance within it, and the probability is, that there are multitudes of paths or circuits in the economy, and that the centres of them are in different places.

Hence the body of the patient is full of nodes or—had I not better say—nodal points. In consequence of this dispersion the physiological action produced by the currents is a very gentle one, much resembling that of the secondarily induced current within the solenoid, and is useful in feeble constitutions, especially those with weak and dilated hearts, for similar diseases.

Owing to the mildness of the treatment there is a tendency to administer an undue length of session: too long a session is calculated to cause fatigue and lassitude, instead of stimulation and even elation. Generally speaking, the time it takes to raise the body temperature one degree Fahrenheit is long enough.

(2) *Terrestrial.*—The patient is attached to one end of the solenoid as before, but in this case a more direct path is provided for the ends of the tubes of force by connecting the opposite end of the solenoid with the earth. The disposition is an intermediate one between the aerial and the true biterminal: It would not be wrong to call it an open circuit biterminal.

The difference of current between this disposition and the aerial is 40 per cent. in favour of the terrestrial. Here are the

actual measurements taken from two individuals of equal weight and approximately equal size:

Aerial— A = 60 and B = 60
Terrestrial—A = 105 and B = 100

The terrestrial disposition is particularly suitable to general systemic diseases, such as those to which I have already referred, occurring in fairly strong constitutions. In these cases it is not necessary or always desirable that manettes should be used, for the arrangement admits of a certain amount of local application. Especially is this the case in regard to local lesions of mucous membranes. Middle ear deafness is much improved by the application of a moist pad electrode or, better still, a dry tinfoil-covered pad, to the mastoid process for five to 10 minutes daily. I have applied the current through a Eustachian catheter, but do not advise this. The chief disease that yields readily to this local treatment is hæmorrhoids. Fissures of the anus, swollen and bleeding conditions of the mucous membrane just inside the anus, but not amounting to piles, and pruritis depending upon such a condition, may all clear up in a wonderful manner after a few sessions of from five to 10 minutes. The particular electrodes used may be a simple metal cylinder, a mirror electrode, or an exhausted glass cylinder. I have also met with great success in the treatment of sub-involution of the uterus by means of an exhausted glass electrode.

(3) *Effluvation.*—The various forms of this method of treatment should be properly classed under the heading of open circuit, but I do not intend to enter upon this branch to-night, as the time will not allow even a glance at so big a subject.

THE CLOSED CIRCUIT.—(1) *Direct Biterminal.*—The patient is connected to both ends of the solenoid by separate wires which terminate in electrodes of different shapes and patterns: manettes, plates, pads, or vacuum tubes.

There is one form of electrode which I have not yet seen mentioned, which is the water cushion electrode; this may be of large surface, say for abdominal use, or for a smaller surface. In the first case, an ordinary indiarubber hot-water bottle answers exceedingly well: all we have to do is to connect one of the rheophores to the metal screw after having filled the bottle; it will be found that this conforms admirably to the contours of the body and makes a very good contact. Where a smaller surface is desirable, I have found that a lawn tennis ball, filled with water by means of a hypodermic syringe, does excellently; an ordinary child's cup from a cup and ball makes a first-class handle. All we have to do is to fix a length of wire in the centre of it: one end of the wire, the fixed end, is connected to the rheophore; the other, or free end, is sharpened, and after the cup has been smeared with

seccotine, the filled ball is pressed on the spike and fixed in the socket. The result is first-rate; but the disadvantage is that the indiarubber soon cracks and perishes, in consequence of the action of the ozone generated.

The electrodes may be applied in a stabile manner, or one of them may be fixed (stabile) and the other moved about (labile), or both may be labile, according to the particular local effect we wish to produce.

We should naturally expect that we should get more current if the electrodes should be of large size than of small size, and this is certainly true to a certain extent; but if you apply exactly the same conducting surfaces to two different individuals of as near as possible the same weight, bulk and surface, you do not necessarily get the same reading on the milliampère-meter, for this will vary according to the health or vitality of the individual: thus, in two healthy men, in whom there is a disparity of years, the one who is in the prime of life will take more than he who is passing downwards or than he who has not yet arrived. This difference is more marked between the healthy and the diseased individual. It is very strongly marked in the same individual when healthy and when diseased; this can easily be ascertained in a patient just previous to and just subsequent to an attack of gout. The difference is marked over different structures of the body. If one is using the labile method, a difference of five milliampères may be noted between deep and slight pressure. I have found that pressure on a tumour will give a higher reading than pressure on the neighbouring structures. Not only in this method, but in all direct applications, I have found that the right hand invariably takes more current (from three to eight milliampères) than the left hand. The case in which this was least marked was that of a man who used both hands equally in his trade. I have not had the opportunity of experimenting on a left-handed man. Here is a measurement (the two manettes are fixed respectively to the two branches of a flexible lead):

One manette in each hand	= 300	milliampères.
Two manettes in right hand	= 225	,,
Two manettes in left hand	= 215	,,
Both hands on two manettes	= 295	,,

In connection with this experiment some further measurements are interesting as they show the effect of surrounding conductors. A manette was now taken in each hand and held close to, but not touching the breast: the reading gave 315 milliampères.

Both hands were now held well over the head as far away as possible: the reading gave 285 milliampères.

One hand was now held near the breast and the other alternately raised over the head: the reading was 295 milliam-

pères, for both right and left hand. One flexible wire was attached to a metal plaque (75 square inches) placed over the epigastrium. The other flexible wire was attached to a metal plaque (65 square inches) placed over the loins.

The readings were:		I.	II.	III.
with milliampère-meter on the epigastric wire	=	350	350	350
,, ,, ,, ,, lumbar ,,	=	350	350	350
,, ,, ,, ,, earthed ,,	=	—	110	10

I.—Plain biterminal.

II.—One end of solenoid connected to earth.

III.—The centre, or node, of the solenoid connected to earth.

Physiological Effects.—The diagram given on page 69 of our journal will fully explain the action of waves of concentration in various circuits; the letter C will show where the nodes occur, and it is evident that by the labile method we can fix those nodes fairly where we please.

Perhaps one of the most striking effects of the biterminal treatment is the relaxation of the muscular tissues. I have made use of this in relaxing the walls of the abdomen as an aid to the diagnosis of doubtful cases, and for this purpose alone I regard it as a most valuable help to the physician. This relaxation is of the greatest service in the reduction of dislocations and subluxations, but it must be borne in mind that this relaxation persists for some time. The muscular walls of blood vessels relax and, as they tighten up again, effusions are absorbed.

By their relaxation asthma and bronchial spasm are eased, and so are other annoyances caused by spasm. Uterine fibroid tumours become softened and absorbed; and it is not at all uncommon for uterine fibroids to become pedunculated under this treatment. I have found that cancerous growths within the abdominal cavity develop a tendency to become encysted. I have seen the growing edge of malignant tumours definitely recede, by application of an exhausted glass electrode; I have also seen the whole tumour shrink and become less when a metal plate has been placed over it, but there is one point in the treatment of malignant disease which I regard as absolutely essential: the wave-length must be kept short, and the amplitude of the waves not too high. If too much impedence is placed between the armatures, no good will be done. It is better to remove the solenoid we ordinarily use, and substitute for it one with fewer loops.

It is in this arrangement that we are likely to get the best effects of phoresis. Tophi, swollen joints, and sprains are all benefited by this treatment. There is one more disease I should like to mention in connection with this subject as being very amenable to treatment, and that is ovarian pain. A metal (tinfoil) plate over the affected ovary

with another plate across the sacrum for 10 minutes or so often acts like charm.

There remains to be considered the reason of the increase of temperature in the skin immediately in contact with the electrodes, and that of the body generally. Many reasons have been given for the increased heat in the skin, and the explanation offered by Reus, that it is due to the ohmic resistance of the skin, seems to find most acceptance. My own opinion is that it is due to the polarisation of the cells of the upper layers of the skin, and I should not be at all surprised if this were to be found the real reason of X-ray burns.

The cells of the economy generally are situated in a much more elastic and yielding medium, but in this case, when they are subjected to electrical influence, the polar disturbance is sufficient to cause an increase in the systemic temperature. In regard to systemic temperature in all applications, I am of opinion that it is the safest guide upon which to rely in estimating the optimum duration of a session.

I still hear it maintained that currents of high frequency do not enter the body, but merely exist on the surface of it, as a static charge. Some of you will remember that I endeavoured, in this very room, to furnish a proof that they do penetrate. Since then I have devised a better test, and with complete success.

To one end of the solenoid I attached the subject by a long flexible cord, furnished at the end with a large capacity contact (65 square inches of tinfoil). To the other end of the solenoid a similar cord was affixed, the distal end of which was connected to the milliampère-meter; from the latter, a short wire proceeded which terminated in a small capacity at the bottom of a porcelain utensil placed on an insulating stool. The current was turned on and a reading taken off the meter. Next, the subject urinated into the utensil, with the result that the needle of the meter immediately moved up, thus indicating that a more direct path had been provided for the current, by the stream flowing from the subject.

To meet the objection which might be raised, that even then the electric charge existed on the surface and passed as a current from the mucous orifice connected with that surface to the stream which issued from it. In a succeeding experiment, I passed into the bladder a gum elastic catheter, the free end of which was attached to a long indiarubber pipe, of the size used in babies' bottles. The other end lay in the porcelain utensil. The same manœuvres were adopted as in the previous experiment. Evidence of an increased current was again obtained.

In the biterminal application, all the waves which enter the patient are quenched in his body, from which there is no radiation. In a case, taking 530 milliampères, with one large

metal plaque over the right lobe of the liver, and another similar plaque, each measuring about 70 square inches over the splenic region, a Geissler's tube held near did not glow. Actual contact did not cause it to glow, even when placed on the epigastrium between the two plaques. When a metal contact was approached to the skin, only the very faintest sparks could be obtained.

And now, gentlemen, I must bring my paper to a close, as I have already filled up the allotted time, and I do not wish to trench upon that apportioned to discussion. I should like to have spoken a few words about condensation, and compared this method of treatment with other methods; but condensation, together with effluvation and combined currents, must be left to a future occasion.

Dr. HEATON asked whether Dr. Manders had been able to compare the results of his experiments carried out last year, as to the oscillatory current changing at a critical point into a unidirectional current. Dr. Heaton has been experimenting with a mercury vapour tube with the idea of rectifying the current, and found that when the tube was inserted in place of solenoid between the external armature, the oscillatory clumps of light appeared, but when used in derivation in shunt from the solenoid the light in the tube was uniform, and that there was no loss of current, as shown by the milliampère-meter.

Mr. CHISHOLM WILLIAMS, in congratulating Dr. Manders on his paper, trusted that the members would have an opportunity of hearing the rest of the paper at a future meeting. He did not quite agree with the reader regarding the newer nomenclature in the Journal and elsewhere, which would only tend to confusion. Take, for instance, the word "session," which had been brought forward to supplant "application"; the former denotes a period of time, the latter actual work, which is a more correct term. His experience of auto-conduction was most disappointing, and had been given up by him; he greatly preferred condensation as a quicker method, and with less "suggestion" about it. The purely physical phenomena of high frequency currents was of special interest to the manufacturer and scientific student, and Dr. Manders' papers were always full of experiments, etc., in that direction, for which the members of the Society must be grateful.

Dr. DONALD BAYNES said: Dr. Horace Manders' paper at any rate shows the necessity of a synopsis of the papers, cases, etc., that are brought before the Society accompanying the notice paper, as then one would be better prepared to discuss the paper, and also have the opportunity of consulting notes of cases, and thus be able to bring forward analagous cases for comparison. I should also like to hear how Dr.

Manders arranges phoretic applications with high frequency currents. I agree with Mr. Chisholm Williams in thinking the word "session" is not a suitable term. (See under special Notice, Rule 17.)

Dr. A. W. SIKES said he was very pleased to hear that Dr. Horace Manders had examined many of his cases with regard to pulse, temperature, urea passed, etc., and said he thought that we ought to do so in as many cases as possible; that pulse tension and frequency, and temperature should always be registered, and, if possible, the urea and uric acid passed estimated, although, as he had found with private patients, these latter were very difficult; and that it was only in this way the subject could be put on a sound pathological basis.

Dr. Sikes had also noted the variation of the needle of the milliampère-meter, under exactly similar conditions, with different patients, and thought that it was due to the weight of the patient, but probably the explanation Dr. Manders had given was the more correct one.

Dr. Sikes said that he had read and heard very conflicting reports as to the effect of high frequency currents on diabetes, and would like to know what Dr. Manders' experience had been.

Dr. GEORGE B. BATTEN thanked Dr. Horace Manders for his paper, and said he thought that if complexity of methods in applying high frequency currents was necessary, then we must have complexity, but hoped as all the variations of application were really only different ways of applying the same current, that we should be able to reach simplicity; at the present time he thought we could not be *dogmatic* about certain methods for certain complaints, as we did not yet know enough about the subject, although a vast amount of experience was being accumulated. He asked Dr. Manders how he secured the short wave-length, which he recommended for treatment of malignant growths. He related an accident due to sparking across a celluloid insulator of a couch which set it alight.

REPLIES TO REMARKS.

(1) To Dr. Heaton.—Dr. HORACE MANDERS said that he had not made any further experiments on the critical point of change of type from an oscillatory to a unidirectional current, as he had ascertained the phenomenon definitely, and it did not seem to have much practical bearing on therapeutics. The fact that the light is uniform, when the tube is within the shunt circuit, might be due to a small amount of unidirectional lysis through the vapour tube; the main discharge taking place by oscillations through the solenoid.

His attention had first been directed towards the treatment of middle ear deafness in consequence of the remarks of the friends of a patient who was undergoing treatment for quite a different condition. They had noticed that his hearing was much improved.

(2) To Mr. Chisholm Williams.—He did not think that the term "session" was intended to supplant "application," as the latter term refers to the act of treatment, the former to the duration of time, during which one or more acts or applications are used.

He thought that the large solenoid had its uses, peculiar to the currents set up, and chiefly suitable to weakly people.

He thanked Mr. Chisholm Williams for his kind remarks.

(3) To Dr. Donald Baynes.—Phoresis could only be expected from the biterminal disposition; the method is to place the same drug in solution under each of the terminals connected to the body. He had chiefly used methylene blue and iodide of potassium. Although pain had been greatly relieved, he could not say that it was actually due to phoresis, insomuch as he must confess that he had never been able to detect either of these substances in the urine; subsequently, perhaps once, he thought that nitric acid and chloroform had given a faint characteristic reaction, but he could not be sure. The attempt at phoresis by this mode of high frequency was suggested by the following:—

Let a solution be made of one or more salts, a portion of which is retained for after comparison, and the remainder poured into two receptacles each divided by two porous diaphragms into three portions. Let one of these receptacles be submitted to the action of an alternating current at high potential, flowing from end to end. After a time, it will be found that in the receptacle submitted to the action of the current, the contents of each compartment will differ in specific gravity and in chemical quantities from those in either of the other compartments in same receptacle. Furthermore, that they all differ from the contents of the receptacle through which no current was passed, each compartment of which retains its original solution unchanged.

To Dr. Batten.—Dr. Manders admitted the nuisance of complexity of detail and nomenclature now prevailing, and hoped that it would soon be cleared up by each giving his own ideas of what is most correct, in open meeting. It could then be finally settled. In regard to technique, he was convinced that different methods produce different results respectively.

He thought that the fact that the current marked by the milliampère-meter went through the patient was attested by the same reading being given on each side of the patient, but he did not aver that the meter actually recorded milliampères.

To Dr. Sikes.—The variation of the needle not only depends upon the causes already stated, but also upon the alteration of any capacities near the patient: operator, etc., approaching or receding from him.

Dr. Manders had had only cases of glycosuria occurring in adults, but no cases of diabetes occurring in the young, which was quite a different condition, and one invariably fatal. He thought diabetes to be a symptom of several different lesions, and that each case should be treated in a mode suitable to the arrest of the pathological condition. Perhaps we might succeed. Medicines were powerless.

The wave-length can be reduced by decreasing the inductance. The reduction of the inductance is equivalent to lessening the load on a vibrating spring.

NOTICES.

Members taking part in discussions or making remarks on papers, etc., are earnestly requested to give their notes on same to the Secretary at the end of evening, so that the proceedings may be complete and not delay the prompt publication of the Journal.

Publications.

17.—The proceedings shall be published in such a manner and at such times as the Council may direct. A copy shall be forwarded to each Honorary and Corresponding Member of the Society, and to every Ordinary Member whose subscription is not more than one year in arrear. Fourteen days' notice should, whenever possible, be given to one of the Secretaries by any member who wishes to show a clinical case or to make a communication to the Society. A copy of the paper in a form fit for publication in the proceedings must be furnished at the same time. The paper shall be the property of the Society for publication in the proceedings, without prejudice to the author's right to reprint or insert in any recognised medical paper or periodical. In all such cases the author shall state that the paper was read before the Society.

Members are reminded that the annual subscription (one guinea) became due January 1st, and should be sent to either Honorary Secretaries at their earliest convenience.

On June the 24th the second Annual Dinner will be held at the Trocadero at 7 for 7.30. Dinner 7/6 (ex wine). It is hoped that the members will give the committee their hearty support. Dr. Samuel Sloan will read a paper at the Ordinary Meeting at 11, Chandos Street, W., at 5.30 on the same date.

In July a business meeting will be held at the Oxford Meeting of the British Medical Association, date will be announced later.

On October 28th Dr. C. A. Wright has kindly promised a paper.

On November 25th Dr. Gamlen has kindly promised a paper illustrated with lantern slides.

In December will be held the Annual Exhibition.

SCHLEUSSNER'S
SPECIAL
RÖNTGEN PLATES.

The Finest Procurable for X-RAY WORK.

The following are a few Testimonials (among many) which should convince all Medical and Scientific Men of the value of these Plates for Special Work:—

Prof. Dr. A. HOFFA, Institute of Orthopædic Surgery, Würzburg:— "Have used your dry plates for many years, especially for Röntgen-Ray work, and have always found them highly satisfactory."

E. H. HOWLETT, Hull:—"The best plates I have ever tried for Röntgen-Ray work."

Prof. Dr. F. KRAUSE, Chief Surgeon, Municipal Hospital, Altona:— "Our Röntgen-Ray photographs have been exclusively taken with these plates, and they have always behaved excellently."

These Plates may be obtained from Photo. Dealers, or from the Sole Agents for Great Britain:

THOS. CHRISTY & CO., 4, Old Swan Lane, LONDON, E.C.

MEDICAL

Electrology and Radiology.

No. 7. JULY, 1904. Vol. V.

EDITORIAL.

The Editor avails himself of this, his last opportunity, to bid farewell to his readers. His retirement is due, not to any recent occurrence, but to a long contemplated step which, for various reasons, has hitherto proved impracticable. He takes advantage of the occasion to offer his unstinted thanks to the Associate Editors and Editorial Committee for their valuable and disinterested collaboration, and to an ever widening circle of readers for the interest they have shown in the Journal, and for the forbearance with which they have regarded its numerous shortcomings.

No pretension can, at present, be made to define or even to give a systematic survey of the physiological sphere of influence of the various phases of energy, that are collectively known as focus-tube radiations or discharges. Their active constituents are but little understood, and present views are based upon fundamental theoretical assumptions rather than upon direct scientific determinations. Therefore, pending the investigation and analysis of these discharges, the main object of Radiotherapy must be chiefly explanatory—limited to an attempt in the first instance to establish a connection between a rudimentary knowledge of physical phenomena and such data as are available from clinical and experimental research; and next to smooth, as far as may be, the difficulties that beset the path of the operator, pointing out where hidden pitfalls lie, and at the same time dealing with all relevant questions with a constant view to their practical application.

It is evident that the very restricted extent of present knowledge of the more purely physical properties—additive, constitutive and colligative—of the Röntgen rays must still further tend to limit our acquaintance with their more complex physiological and pathological actions. The momentous question of their therapeutic possibilities cannot, *a fortiori*, be

decided by emphatic assertion or equally unqualified negation. The discreet observer will keep an open mind and a guarded tongue until accumulated knowledge warrants the formation of a sober judgment.

Without any fear of contradiction it may be said that absolute rectilinear propagation is, *par excellence*, the additive property of the X-rays, and that no other property is additive in the strict sense, although there may be some approximation to the additive character. The extraordinary penetrative power of the rays and their inherent tendency to promote electrical leakage well exemplify the latter, for it is obvious that properties have here to be dealt with, whose additive character is distinctly modified by contingent influences. It may, for instance, be pointed out how largely the penetration of the X-rays are determined by the speed of the cathodic rays in the focus tube, and how this in turn depends on the degree of vacuum present. Again, it may be noticed that ionisation —that singular property of the rays which promotes electrical leakage from an electroscope, even when positively charged— is most in evidence when the medium of transmission is in the gaseous state. It is therefore manifest that penetration is in part constitutive, whilst ionisation is a colligative property of the Röntgen rays. Their internal physiological and pathological effects are manifestly colligative, inasmuch as in the reaction cellular vitality and intracellular chemical composition play an important part.

As the internal effects of the X-rays are but little known, some of their more important effects may here with advantage be mentioned. Sir Oliver Lodge, in his recent "Lectures to Medical Practitioners on Physics Applied to Medicine," drew attention to Ionisation as "the most important medical property possessed by the X-rays," and, in speaking of the effects of X-rays upon the body, adds: "as regards the cells of the body, they act most on active cells where changes are occurring. I should expect them therefore to act more on the dermis than on the epidermis. It would be odd if they did not act on the hæmoglobin of the blood." These very shrewd conjectures as to their physiological action, based upon purely physical considerations, have

been established by Experimental Observation, the former by microscopic examinations of the exposed cutis by Darier, Unna, Jutassy and Minich among others, and the latter by the clinical observation of M. Mauté, as well as by the experimental researches of H. Heinecke. Mauté has carefully studied the cellular composition of the blood in cases treated by radiotherapy (exposure 2 to 6 minutes), and has noticed that during the hour following the exposure, there is an appreciable modification of the cellular equilibrium of the blood which is attended by an increase in the number of both the white and coloured corpuscles, the percentage of polynuclear and large and small mononuclear cells being greater than normal. The leucocytosis thus induced is analogous to that set up by revulsive applications (vesicants, cold, etc.) or that which attends digestion. Heinecke's experiments, on the other hand, go to prove that the lymphoid structures of the body are even more susceptible to the X-rays than the cutis. In small animals exposed to the rays for some hours the spleen showed an excessive increase in pigment, a disappearance of the follicles and a general destruction of the splenic pulp. The follicular changes were noticed soon after the exposure to the rays and were completed in 24 hours. The nuclei of the lymphocytes in the follicles are first disintegrated, their remnants being removed by phagocytes, which in turn disappear from the spleen when the destruction of the follicles is complete. It was found that an exposure of 15 minutes is sufficient to start these changes in rabbits and small dogs. In the case of short exposures the amount of destruction is limited and repair can undoubtedly take place. The influence of the X-rays upon the nervous system must essentially be learned from clinical observation, although collateral evidence is afforded by the results of Danysz's experimental studies on the action of radium radiations (γ-rays) on the nervous system in small animals. These practical observations prove that among the cells of the body there are some which react more quickly and delicately to the X-rays than do those of the epidermis, more especially those of the lymphoid group which are influenced long before there is any appreciable evidence of a cutaneous reaction.

ON THE METHODS OF APPLICATION OF HIGH FREQUENCY CURRENTS.

By Clarence A. Wright, F.R.C.S. (Ed.), &c.

(Continued from p. 242.)

Type of Apparatus Employed.—The form of apparatus employed, in so far as it influences the tension and density of the current, affects the local reaction. Transformers, in which the currents utilised for local applications are derived from the small solenoid connecting the outer armatures of the condensers, restrict the limits of graduation; with these no true effluve can be obtained, whilst the transition from eucomides to sparks is sudden. With apparatus designed to elevate the tension of the current, the increased potential extends the limits of graduation and allows of a more easy regulation of effect. These remarks more especially apply to apparatus intended for treatment by double effluvation and the bipolar method; for the inter-action of capacities, here in opposite states of electrification, creates a zone of increasing density.

The Kind of Electrode Employed.—The shape and size of electrodes, in so far as they affect the distribution of the current density or an alteration in its tension, the production of ozone and nitrous compounds, or variations in the character of the ethereal vibrations, exert an influence upon the local reaction: for instance, the results of treatment by high vacuum (X-ray) electrodes materially differ from those by fluid or condenser electrodes; the increased formation of ozone nitrous compounds in the tube enclosing a brush electrode similarly produces a variation in effect that cannot be obtained by the naked brush. The somewhat contradictory statements made by operators, as to the results of treatment by local applications, to some extent is attributable to the differences in the form of electrode employed. The various forms of electrodes will be subsequently discussed.

Details in the Construction and Adjustment of the Various Parts.—The diameter of the wire employed in the construction of resonators has an appreciable influence on the physical qualities of the effluve and spark. A thin wire yields a slender sinuous spark that is scarcely painful, and an effluve as poorly nourished; while a wire of larger diameter increases the intensity of both forms of discharge. When copper ribbon is employed, the effects vary according as the edges or flat surfaces are brought into immediate relation with each other. It may also here be mentioned that the amount of energy in the primary circuit; the size, construction, and output of the coil employed to feed the transformer; the capacity of the condensers; the adjustment of the air-space in the discharger, and the number of spirals in the small

solenoid of high frequency have each and all an influence, more or less marked, upon the character of the discharge and its therapeutical effects. The influence, which adjustment of the various parts has on the results, has already been alluded to and need not here be repeated. The reader will find them referred to in various sections dealing with the regulation of the apparatus employed.

VARIOUS KINDS OF ELECTRODES.—The electrodes made use of in treatment by effluvation are divisible into two chief contactual-groups: (*a*) *Contactual* electrodes that serve directly to connect the body of the patient with one pole of the resonator and render it potentially active, as in eductive and bipolar effluvation; (*b*) *Emicant* electrodes, between whose surface and that of the part treated the current discharges pass.

CONTACTUAL ELECTRODES.—The manette, the button, the plate or disc (both uncovered and padded) are those most usually selected as contactual electrodes in the eductive and bipolar method of effluvation. Among forms that are peculiar to treatment of special cases of disease in particular organs, the following deserve notice:—

Bougie Electrodes.—These are formed of solid metal and inserted in the urethra, vagina, or rectum, as the case may be, in the treatment of atonic conditions of these parts by the revulsive method. They vary in size according to the cavities into which they are to be introduced. When made in one piece with a double curve—a slight internal or pelvic with a larger external or compensatory curvature—they are self-retaining. Their olivary free extremity greatly facilitates introduction.

Irrigation Electrodes.—These are double-channelled and made of indiarubber or metal, and connected by a suitable length of flexible rubber tubing with the metallic douche-can, that is in conductive continuity with one pole of the resonator. The water is here the medium of direct contact and conveys the current as it flows from the can to the body of the patient. To minimise electrical loss, an insulated earthenware receptacle should be provided to receive the waste water.

EMICANT ELECTRODES.—It is impossible in the space at our disposal to give anything like an adequate description of the numerous electrodes that have been introduced for local applications. As in the early days of the midwifery forceps, every operator with any pretence to a special knowledge of the subject has designed one or more electrodes, trusting to a discriminating public, or failing that posterity, to appreciate their problematic advantages and accord him the honours due to a benefactor of the human race. The types rathe

than the peculiarities of configuration, therefore, must at present claim our attention.

Single Wire Electrodes.—In these the length and diameter of wire is proportioned to their use, the probe or ball-pointed type being in most constant requisition. The use of static point-electrodes has been suggested for imitating the effects of the static breeze; but I must say that when employed with a resonator of the ordinary type (maximum 450 m.a.) it has not been a success: perhaps with currents of higher potential better results may be obtained.

Brush Electrodes.—The type usually employed is one made up of a number of fine metallic wires. Its size varies according as the area to be treated is small or extensive. In the latter case several small brushes arranged in parallel rows or concentrically, are mounted on a common handle; these, by diffusing the current discharge over a larger area, minimise pain and limit the local reaction. Under conditions where it is expedient to restrict the action of the discharges to a limited area and by so doing to increase their therapeutic effect, as in the treatment of chronic scaly eruptions and the neurodermites, a cylindrical glass tube open at both ends is slipped over a circular brush, which then acts as its piston. It is claimed that this arrangement not only allows of a concentration of the full intensity of the discharge upon the enclosed area of skin, but also permits of an easier graduation of effect, without unnecessarily exposing the parts to the action of sparks. As the tendency to arcing is greatly increased by the confinement of the air in a narrow tube, I fail to see that it possesses any advantages in this respect over the simpler brush. The ozone and nitrous compounds formed in the confined space, however, exert their own therapeutical effects.

The Condenser Electrode.—Although the small size of the single wire electrode allows of its easy manipulation in confined spaces, it was found in operating on highly sensitive parts, as the face or mucosa, or on those in which normal sensibility was increased by inflammation, that the pain caused by its discharges was often unendurable. This led to its enclosure in an insulating sheath of glass or vulcanite to form what is commonly known as a condenser electrode, so named from its forming with the integument of the part, to which it is approached, a condenser which discharges itself with every variation in the direction of the current. In its original form this electrode consisted of a tube of glass enclosing a central conductor of graphite carbon, the whole being mounted on an ebonite handle. Oudin improved on this model by substituting a metallic wire for the carbon conductor, and by replacing the encasing tube by a double glass container, the outer compartment of which was filled with an

insulating fluid, a heavy hydrocarbon, in order to minimise lateral discharges and allow it to be more easily handled by the operator. Condenser electrodes have since been constructed of the most diverse shapes and dimensions to adapt them to the parts to which they are to be applied, or to the cavities into which they are to be introduced.

Some Points in the Selection of a Condenser Electrode.— The chief points that should determine the choice of a condenser electrode are as follows: The diameter of the wire used to form the centre pin; the finish of its free extremity; the size and thickness of the glass or ebonite container that forms its sheath; the nature of the dielectric that immediately surrounds the centre-pin and separates it from its tubular encasement; and, lastly, the distance between them.

As metal is now almost exclusively employed to form the centre-pin, the variations due to the nature of the material need not here be considered. With metallic conductors conveying currents of high frequency, surface or skin-resistance is a factor of moment; as it not only directly affects the physical qualities of the discharge currents, but also by its heating effects upon the wire influences the local reaction. With a wire of very slender dimensions, the surface capacity being limited, resistance is greatly increased; as the currents tend to almost exclusively confine themselves to the surface. The energy expended in overcoming resistance manifests itself as heat, and the heating of an electrode entails frequent changes during a prolonged session to avoid the pain caused by an overheated electrode. It is evident, therefore, that the diameter of the centre-pin is a point to be considered in the selection of an electrode.

There are few, who use condenser electrodes, that have not had occasion to remark on the careless and unworkmanlike finish of the free end of the centre-pin. Its surface, only too frequently, is left jagged and irregular, without a single attempt being made to shape it. In a good condenser electrode the free extremity is carefully rounded off or provided with a small ovoid or pear-shaped knob, small end forwards.

As the resistance of the dielectric that separates the centre-pin (active armature) from the surface of the skin (passive armature) must be proportioned to the intensity of the current and the purpose for which the electrode is intended, the free space in the interior of the glass container, and the thickness of its walls must, on the one hand, be adapted to the cavity that it has to enter (the possibility of fracture from muscular spasm must here be considered), and, on the other, influenced by the nature of the dielectric used to surround the centre-pin. As air is a feeble dielectric and a worse insulator, more free space is required in the interior of the tubes than when a fluid dielectric of greater capacity is used. The results

of a series of experiments made with tubes of different calibre and thickness, and with fluids of various insulating resistance show that narrow tubes of moderate thickness give the best results when filled with a mixture of alcohol and liquid paraffin (P.B.); with air as a dielectric, sparking increases, and with it the risk of perforation; with a more solid menstrum—sealing wax—the unequal expansion of the glass, heated by contact, causes it to crack when used with currents of high potential. With *resonance* electrodes that further increase the tension of the current, the liquid paraffin answers best when used undiluted. This is also the case with the *roller condenser*.

The distance between the free point of the centre-pin and the rounded base of the glass tube should be proportioned to the nature of the insulating fluid that it contains. Experiments show that it should not be less than 1·48 or more than 2·22 times the distance that separates the wire from the side of the tube. The centre-pin should be straight and firmly fixed into the handle; the use of insulating rubber rings to maintain it in position cannot be too strongly condemned.

Among condenser electrodes of peculiar construction the following call for remark:—

Surface Condensers.—These consist of a thin sheet of metallic gauze placed between two larger layers of vulcanised indiarubber that serve to enclose it. Although it readily adapts itself to the skin's surface, it has all the drawbacks of the fluid electrode and should therefore only be used with currents of moderate intensity. Another disadvantage is that the ozone tends to oxidise the rubber, render it brittle, and liable to crack.

The Flexible Condenser.—These are, to all intents nad purposes, catheters without an eye, with a flexible wire cove, or better still filled with a glycerinated saline solution. They can be introduced, with the greatest ease, into the most tortuous sinuses or fistulæ without causing false passages. The rubber, however, deteriorates with use.

The Roller Condenser consists of a central metalic roller (with projecting axles) encased in a hollow glass or ebonite cylinder filled with a variable amount of insulating fluid. The revolution of the glass wheel allows time for the heated surface to cool, before being again brought into contact with the skin.

The Resonance Electrode.—In this electrode a single layer of insulated wire, coiled spirally about a central insulating support, raises the tension of the current before it is conveyed to the terminal metallic disc. The wire forming the coil and the metallic terminal are enclosed in a common container filled with an insulating fluid.

(*To be continued.*)

X-RAYS IN THE DIAGNOSIS OF JOINT CONDITIONS.

THE HIP-JOINT.

So much difficulty exists in the examination of the hip-joint with the X-rays that no excuse is needed for bringing forward any facts which may help in this connection.

In the anatomy which can be learned from the X-rays we have to view the human frame from quite a different standpoint from that of the dissector. Briefly, we see a

Fig. 1.

Fig. 2.

silhouette of the bones in their actual working positions. As it is impossible to touch, no accurate measurements can be made. Though the shadows can be measured it is not possible to estimate the degree of enlargement—for a shadow must be longer than the object that casts it, and even relative measurements are futile on account of the wide divergence of the rays and the consequent distortion. *e.g.* : the parts at the periphery of the shadow are relatively larger than those at the centre.

It becomes therefore necessary for the user of X-rays to train his eye to see an abnormality without the aid of

measurement. Probably an operator, with a naturally good eye for proportion, will get more information from radiography than another less gifted. Experience teaches that often the first glance at screen or skiagram will convey useful data to the mind which will not be added to by a more prolonged survey. This is possibly explained by the contrast of the normal, which the operator has stored in his mind's eye, with the abnormal outline of the X-ray shadow. The ideal method would be to have a normal shadow to fit over the abnormal, and in this way to see at once the irregularities. Now, this is not possible in general work, but its laboured application in a few instances has led to much useful data in connection with joints.

In the hip-joint there is a line, the broken continuity of which invariably means displacement from injury or disease. This line, in all positions of the joint, *i.e.*, abduction, adduction, etc., of the femur, is the same—an unbroken arch formed by the top of the obturator foramen and the inner side of the femoral reck. Imagination must connect these two lines before a perfect arch is formed, but a glance at fig. 1 will show that this line is a reality and not solely imaginative.

As before stated, in all positions of the femur this arch can be detected.

There are many lesions of the hip which will disturb this line. Congenital dislocation is a good example. In fig. 2 this is well shown. Here it is at once evident that the arch formed partly by the obturator foramen, upper margin, if continued, cannot possibly coincide with the inner margin of the femoral reck.

It is constantly said that the distortion of the rays makes appearances which resemble dislocations in the hip region. To some people distortion may be deceptive, but no amount of distortion will affect this line, and anyone seeing a skiagram of a hip for the first time could say with certainty whether displacement were present or not. Another point is this, that radiograms of the hip region are very often most unsatisfactory on account of the thickness and density of the part. Few radiograms, however bad, will fail to show these two important outlines, and hence the diagnosis will be as correct as if the utmost detail were present.

(To be continued.)

PRACTICAL LESSONS IN THE TREATMENT OF AFFECTIONS OF THE GASTRO-INTESTINAL TRACT BY ELECTRICAL METHODS.

By George Herschell, M.D., Lond.

(*Concluded from p. 236.*)

The Treatment of Constipation.

In constipation even more than in other complaints there is danger in regarding electricity, vibration, massage or some other physical remedy as a panacea, to be used indiscriminately upon all cases regardless of their cause. As a matter of fact, constipation is more often a symptom than a primary affection, and can only be cured by appropriate treatment directed to the disease which it complicates. The cases of constipation which can be effectively treated by the local application of electricity alone are probably very few, being, as far as we know at present, limited to those directly due to defective innervation of the bowel or to atony of the abdominal or intestinal wall. And the number of the latter which can be relieved by electricity is further reduced by the fact that not a few of the cases of true atony of the muscular substance of the bowel are due to a congenital deficiency, incurable by any means with which we are at present acquainted. In these unfortunate cases the most that we can do is to strengthen the fibres which remain, and attempt to establish a *modus vivendi* by the use of periodical injections. In addition to the causes mentioned, constipation may be due to a variety of conditions, among which we find: food containing deficiency of sugar, fat, or cellulose, dilatation of the stomach, acute or chronic gastritis, hyperchlorhydria, anachlorhydria or some other abnormality of secretion, ulcer of the stomach or duodenum, stenosis of some portion of the gastro-intestinal tract, passive congestion of the walls of the intestines, chronic colitis, fatty degeneration of the intestinal muscles (such as is met with in alcoholism and in tuberculosis), local adhesions of the peritoneum, enteroptosis, abnormalities in the rectal valves, and certain diseases of the spinal cord.

Of these, some, such as atonic dilatation of the stomach and chronic colitis, are more or less amenable to electrical methods, and the cure can be much expedited thereby. In the remaining ones such methods must obviously be useless, and it would be only a waste of time to employ them. It is, consequently, of the first importance, before we suggest the use of electricity, to make sure that the case before us falls into the category of those in which it may be used with

a probability of success, otherwise our practice becomes the sheerest quackery, and our inevitable failures will bring unmerited discredit upon a useful therapeutic agent. It is important to remember that even in the cases which we may reasonably expect to receive benefit from electricity, as we are not making scientific experiments, but trying to cure our patients *cito, tuto, et jucunde*, we must not neglect the dietetic, hygienic, and medicinal treatment of the patient. The greatest difficulty in the management of patients with constipation will be found at the commencement of the course of treatment, when enough tone has not yet been restored to the parts to secure a daily movement of the bowels. . In all probability it will only be after some weeks of treatment that this occurs, and in the interim the bowels must be kept sufficiently open to prevent any considerable degree of discomfort. As a general rule we should stop all laxative medicine at once, and rely upon the use of injections of olive oil or water in conjunction with diet, except in cases such as gastric myasthenia, in which we are prevented from giving an appropriate menu. Under these circumstances it may be necessary to supplement the non-stimulating food by a daily dose of a mild laxative such as cascara, which should be looked upon as a temporary expedient to be used until we have cured the stomach condition sufficiently to be able to order the green vegetables, fruit, sugar, brown bread, etc., which are indicated. In cases of atony of the stomach, the main cause of the constipation appears to be due to the deficient amount of liquid which leaves the stomach. It will be sound practice in these cases to supplement this by nightly injections of water into the lower bowel to be retained until morning.

The cases of constipation in which we can do the greatest good by electrical methods are those due to—

1. Weakness of the abdominal muscles;
2. Defective innervation and atony of the large intestine;
3. Blunted sensibility of the rectum.

Treatment of Weakness of the Abdominal Muscles.—There are several electrical methods by which we can restore tone to the abdominal muices muscles, and any one of them will give good results in competent hands, the *sine quâ non* being that rhythmic muscular contractions are set up in the muscles of such intensity as to work them to their fullest useful capacity, and to allow such a period of rest between each contraction that the muscle may be recuperated and not exhausted. For this purpose we may use—

The Triphase Alternating Current.—One large electrode should be placed under the lumbar or gluteal region as the patient lies on a couch and the other two electrodes upon the abdomen, one on each side of the middle line. The abdominal

electrodes are kept in position by gentle pressure or by the weight of a bag of shot upon each. The great advantage of the shot bag is that the muscular contractions set up by the electrical current have to raise the weight placed upon them, and thus we secure resisted movements, which we all know are calculated to bring up a muscle quicker than any other form of exercise. The best way of manipulating the current is first of all to regulate the brake so that the fly-wheel is revolving very slowly, at perhaps 50 revolutions a minute. Resistance is now taken out from the patient's circuit until the abdominal muscles commence to move. Now, stop moving the rheostat, and gradually relax the brake allowing the fly-wheel to quicken until you have obtained the amount of muscular contraction which you think desirable.

The Morton Current.—Cases of muscular weakness of the abdominal walls can be treated very efficiently, the size of the jars and the length of the spark gap being regulated to give the required amplitude of muscular contraction.

The High Frequency Current from the small solenoid with a spark gap in the circuit will produce similar results to the Morton current, and may be applied in a like manner.

Induction Coil Current with slow interruptions and the **Constant Galvanic Current, mechanically interrupted,** may also be used with good results in the manner already described.

Treatment of Defective Innervation and Atony of the Intestines.—In the treatment of this condition I have never seen any good result from the induction coil current, and my successes have all been obtained with the sinusoidal, monophase or triphase, or with the constant galvanic current. I think that it is not sufficiently realised among electrotherapists that for all practical purposes the sinusoidal current is really a galvanic current which varies regularly in quantity and direction, and that the variations appear to determine rather the intensity than the quality of its action. For instance, with a sinusoidal current a solution of iodide of potassium will be decomposed by both poles, whilst with the faradic current nothing of the kind occurs. We may therefore expect to find a certain similarity in the therapeutic effects obtained by the galvanic and sinusoidal alternating currents. Whichever current is used, the technique is practically the same and may be conveniently described at the present stage. The best results are undoubtedly only to be obtained by using an electrode in the rectum, and the author has described elsewhere* a rectal electrode which offers the advantage of the large contact sur-

*Polyphase Currents in Electrotherapy. London, 1903.

face usually obtained by filling the rectum with water without the mess attending this procedure. The electrode in question consists essentially of a perforated rubber tube through which runs a metallic spiral to carry the current. The tube is surrounded by a sheath of animal membrane which is distended with water after the apparatus has been introduced into the rectum. With such an electrode in the rectum attached to one pole of a **triphase** machine, the second and third poles attached to oblong flat electrodes placed respectively over the ascending and descending colon, the whole intestinal canal can be subjected to very intense action. For the restoration of tone to the intestines a slow phase should be used with just sufficient current strength to set in motion the abdominal muscles. For improving the innervation of the abdominal viscera, a rapid phase is made use of, the current strength being that which will just fall short of contracting the muscles.

If we make use of the **monophase sinusoidal current** we shall regulate the rapidity of phase in the same manner but use a moderate sized electrode labile along the course of the colon with slow phase to restore tonicity to the muscles of the intestine, and a large electrode stabile over the abdomen with a rapid phase in cases of defective innervation of the splanchnic area.

If neither monophase nor triphase sinusoidal currents are available we must do the best we can with the **constant galvanic current** producing an artificial sinusoidal current in the manner described upon page 188.

Treatment of Defective Sensibility of the Mucous Membrane of the Rectum.—It is now held by physiologists that the rectum is normally empty, and that it is the impinging upon the upper surface of the superior rectal valve of fæcal matter coming down from the sigmoid, which initiates the nerve impulses necessary to start the reflex act of defecation.

"The valves receive a series of boluses, till a sufficient pressure is made to stimulate the complex involuntary mechanism of defecation to a propulsion of the fæces or to a reverse peristalsis. The presence of the fæces, or the involuntary movements incident to their presence, signals the consciousness to co-operative voluntary expulsory effort, or gives warning of the necessity of voluntary resistance. In the event of the exercise of these forces in the direction of resistance, there seems to be reason to believe that an antiperistalsis returns the fæces to the sigmoid flexure."*

In cases where the call of nature is habitually neglected the sensibility of the rectum and its valves will gradually be

* "Obstipation; a Practical Monograph on the Disorders and Diseases of the Rectal Valve." By T. C. Martin, Professor of Proctology in the Cleveland College of Physicians and Surgeons. Philadelphia, 1899. Page 76.

lost, neither propulsion nor anti-peristalsis will take place, and the rectum, instead of being normally empty, will become blocked with fæces.

We have here an obvious explanation of a number of common cases of constipation, and our common sense tells us that the most scientific and appropriate treatment will be to try and restore the lost sensibility to the mucous membrane of the rectum. Fortunately, much can be done by electricity, and in many cases we shall obtain brilliant results if we can induce the patient to undergo a course of treatment of sufficient length. Unfortunately, the average patient is rather unreasonable, and expects us to magically cure an affection of long standing and slow growth by one or two applications of electricity. The method of treatment which has given the best results in my hands has been the application of a gentle **sinusoidal current** to the interior of the rectum by means of a **bipolar electrode.** The electrode is constructed on the model of the well-known bipolar vaginal electrode, and consists of a vulcanite rod terminating in a metal cap. Around the stem, some two and a half inches from the tip, is a band of metal of half an inch in width. Both the metal cap and the metal band are connected to binding screws upon the handle by means of wires traversing the centre of the instrument. As regards the current strength to use, we must remember that the sensibility of the rectum being defective, it will be much too strong by the time the patient feels it. You will therefore test it for yourself before introducing the electrode into the rectum. Well wet your hand with water containing a little carbonate of soda, grasp the electrode, taking care that both the metal bands are in contact with the skin. Now start the machine and turn on the current until you can just feel it comfortably with the grasping hand. A shade less than this will be the correct dose. Note the position of the rheostats of the machine, turn the current back to zero, and introduce the electrode, lubricated with soap or glycerine jelly, into the rectum of the patient, who is lying in the left lateral position upon a couch. Take care that the proximal metallic band has well passed the internal sphincter and turn on the current gradually until the rheostats are in the position which they occupied when you made the test. The application should last for about 10 minutes, and a daily treatment for a fortnight having been given, an application three times a week for a couple of months should make a great difference in the condition of the patient.

THE TECHNIC AND EFFECT OF TREATMENT BY BLUE LIGHT

(abstracted by Dr. SYDNEY WHITAKER, from an article by Dr. GUSTAV KAISER, in the *Wiener Klinische Rundschau* for April 19th and 26th, 1903).

The author remarks that blue glass for this purpose must first be tested, since most of the blue glass in everyday use is unfit for therapeutic use as it allows all the colours of the spectrum to pass through. He uses a 15 to 30 ampère arc electric light—the horizontal carbons of which are fitted with the usual automatic movement mechanism. This light is enclosed in a cylinder which is freely movable in all directions, and at the back of which a reflector is placed—the end of the cylinder toward the patient being open.

Between the cylinder and the patient stands the blue light —irradiation—filter for dispersed light which consists of a wooden stand, 170 cm. high, supporting a reversible frame in which narrow strips of blue glass are inserted, the glass being in the form of strips in order to carry away most of the heat, and also because if they crack the damage is but slight. In order to prevent light going between the fissures the frame is placed somewhat obliquely. For the same reason other apertures in the apparatus are filled in with black cloth.

The patient sits behind the filter opposite the blue glass which can be set higher or lower as required, and the beam of light is directed through the glass on to the exposed diseased part for half an hour.

When, however, the disease is deeply seated two concave glasses containing a solution of alum to absorb the heat rays are placed in the screen in place of the strips of glass and the diseased structure is brought into the focus of this lens. In the case of very deeply-seated lesions, however, a concave lens is interposed in the cone of light coming from the lens—a more or less concentrated parallel beam of light being thus produced with consequent shortening of the time required for treatment. Any slight heat felt by the patient is probably due to yellow rays which have not been absorbed by the alum solution, this solution being constantly changed by a special apparatus. The reflector is placed at just such a distance from the glass strips or lens that they will not crack with the heat. In the case of a continuous current of 20 ampères this distance was about 2 metres, while with an alternating current it was ¾ metre. During the *séance* the patient wears tinted spectacles.

Tuberculous diseases of the skin, joints, and bones, heal with a beautiful white scar. A distinct reaction occurs after

from 14 to 20 *séances* of half an hour each, the treated portion becoming slightly reddened and a scab forming, which falls off in a few days leaving a beautiful cicatrized place. With deeply-seated lesions progress is of course slower.

Internal organs also react to the treatment, *e.g.*, the lungs, which oppose a very slight resistance to the beam of light. In two cases of tuberculosis of the lung which were treated, the nightsweats disappeared after a few *séances*, along with improvement of appetite, increase in weight, and a diminution in the number of bacilli in the sputum.

The cases cited are the following :—

Frau Marie E. had lupus vulgaris of the nose and right cheek for two years. She was treated by the blue glass strips, and after the 17th *séance* there was a distinct reddening, which soon became pale and left a strong scab. After the 40th *séance* there was a smooth reddened scar, which after the 70th *séance* quite harmonised with the colour of the surrounding skin.

Frau Ernestine P. suffered for four years with lupus erythematosus which spread over both cheeks and the whole forehead. She has hitherto been treated by all available methods but without result. She has so far undergone 72 *séances* with the result that the redness has disappeared, and the patches—especially on the right cheek and forehead—are already considerably smaller. To all appearance the lesion will be healed in two months.

Rudolf P. suffered for two years from a tuberculous ulcer on the right forearm which was of varying size, being at one time large, and at another small. After 11 *séances* the redness and irritation were less, and after 27 *séances* a dry scab fell off and there was complete healing.

The author thinks that the bacilli die through deprivation of nourishment, and that the effective rays are the chemical ones which are in the visible spectrum (by which the author seems to mean the blue and violet rays) and those rays of the ultra-violet which are close to the violet.

The author performed the following experiment to prove that the visible chemical beams (*i.e.*, the blue and violet) can pass through the body—though even these are largely absorbed en route.

A medium-sized man was placed in a dark room, and a photographic negative was placed on his back. Over this negative was placed a prepared positive film—the whole being fastened on with plaster. A beam of blue light was then thrown on to the thorax (apparently on to the front of the thorax S. W.). According as the thorax of the patient was large or small so it took a longer or shorter time to blacken the film. When a film only was pasted on, there was produced, after 25 minutes or so, a picture resembling a Röntgen

positive—since the blue and violet rays penetrate the bones which have not a rich blood supply better than other blood rich tissue.

The author considers that in its passage through the body the beam is absorbed by the different layers of tissue which it encounters—the greatest absorption taking place at the first layer, and a small portion passing out of the other side of the body unabsorbed.

From his experiments he draws the following conclusions:—

1.—Blue light considerably stimulates metabolism.

2.—This action is mainly due to the more refrangible rays.

3.—It is directly proportional to the distance and intensity of the ray of light.

4.—Blue rays penetrate vascular tissue so easily that a deep effect cannot be denied.

5.—They have a strong absorbent and anodyne effect, and in a concentrated state are slightly anæsthetic.

BILATERAL FACIAL ATROPHY, WITH REPORT OF A CASE AND ITS TREATMENT BY SUBCUTANEOUS INJECTIONS OF PARAFFIN.—The rarity of this condition is considered by Benjamin T. Burley, who reports a new method of treatment. The patient, a young woman of 23, had a severe attack of pneumonia at eight years of age, from which she recovered, remaining well until 11, when she suffered from another attack of pneumonia. She seemed to make a normal recovery from this; it was soon noticed, however, that her face, instead of regaining its normal fulness, became progressively thinner and her cheeks were sunken. Tonics were administered, under the impression that the condition was due to a general malnutrition; but the shrunken condition of the face continued, despite apparent normal health. After keeping the patient under observation for two months, it was decided to use paraffin subcutaneously to replace the lost tissue. One and five-tenths centimetres of paraffin, at the melting point 109·5° F., was injected below each molar process at the first sitting. The subsequent swelling, which was slight, disappeared in 24 hours. At intervals of a week similar treatment was carried out, the process of filling beneath the skin being extended outward and downward. Nine treatments in all were given, and the result at the time of the report was so satisfactory as to preclude the necessity for further interference.—*Boston Medical and Surgical Journal*, April 14th, 1904.

(The question arises as to whether an expenditure of electrical energy, or of mechanical energy for that matter, might not have served to promote the nutrition of the shrunken muscles to such an extent as to have obviated the necessity of leaving a foreign mass within them. From the well-known power of a magnetio-induced current with a slow interruption to promote physiological hypertrophy, such a result would be expected.—AM. ED.)

CORRESPONDENCE.

The Intrusion of Laymen into Medical Practice.

Sir,

Dr. Lewis Jones' presidential address on the intrusion of laymen into medical practice, seems to me to have merited wider attention in the medical press than it received, while the suggestion of one of the weeklies* that the remedy lay in the profession reducing their fees, shows that its knowledge of the ways of those unqualified persons dealing in electro-therapeutics is not very extensive.

A few instructive cases have lately come under my notice, illustrating well both the method of treatment and the fees charged at various electrical establishments, which may be worth noting.

A patient with Menières disease of some years' standing was sent to me for treatment by the high frequency current; he told me that he had paid £25 to an "institute" for motor-vibration of the ear, that the money was paid in a lump sum before the treatment began, that the ear was never even examined, and that he received no benefit from the treatment in spite of the constant hopes held out to him. As I, unlike the institute, was unable to promise any relief he soon deserted me.

Another patient, suffering from neurasthenia, with tachycardia, exaggerated reflexes, etc., was submitted to 150 electric baths at a cost of nearly £200. Later on he had daily applications of the high frequency current, sitting on the auto-condensation couch for periods varying from 30 to 45 minutes at a time, with an electrode in one hand and a newspaper in the other! Finally, the abdomen was rayed several times—after which he completely broke down and had to go into a nursing home for many weeks.

A "specialist in medical electricity," whom I visited lately, was good enough to offer me 25 per cent. on the fees of all cases I sent him, and assured me he was largely supported by "well-known" medical men. He used no ampère-meter or milliampère-meter, did not hesitate to pass instruments into the vagina and rectum, and charged "large lump sums" for this valuable treatment.

The proprietor of a well-known bathing establishment in London advertises widely that he "will give his opinion and

---

British Medical Journal, May 7th, 1904, p. 1090.

advice on any case, through the post, for five shillings in stamps." Some of his other charges are:

High frequency currents, from 10/- to 20/-:

Electric light baths, from 10/-;

"Local applications of light treatment, according to time."

At another institute, the proprietor of which is not unknown on the music-hall stage, the fees are 10/6 for 20 minutes' treatment (local or general), and a guinea an hour for light exposures. Among a long list of cases in which "an absolute cure is practically guaranteed," are to be found—enlargement of the prostate, rickets, and the vomiting of pregnancy!

The various institutes which flourish in our midst seem to owe their success to the wide support given them by our own profession, to their ubiquitous and brazen advertisements, and to the unlimited faith which the gullible public place in the specious promises of certain cures held out by them.

The legitimate practitioner who, at a large cost of time and money, makes a special study of electrotherapeutics must needs be heavily handicapped against such unjustifiable competition, and surely merits the support of his brethren.

P. A. NIGHTINGALE, M.D.

Ludgate Hill, July 1st, 1904.

* * *

SURGICAL INSTRUMENT MAKERS AND X-RAYS.

SIR,

Having recently required some surgical apparatus, operating tables, etc., I visited a firm in London and examined some which suited my purpose admirably. On my return home, in looking over their catalogue, I observed that they used X-rays. I wrote and cancelled the order, telling them I could not support a firm who was acting in direct competition with members of my profession. I now hear from the said firm "that they have given up X-rays," so my good intentions have been frustrated. If medical men would only be true to the best interests of their profession, and thereby the best interests of the public, by dealing only with those firms whose conduct in their business is above suspicion, then we should hear little of X-rays lay practice. I shall be pleased to give any medical man the name of the firm mentioned above; needless to say it was NOT Messrs. Allen & Hanbury (see *Journal of Electrology and Radiology*, January, 1904).

CHISHOLM WILLIAMS.

Bedford Square, June 30th, 1904.

LECTURES TO MEDICAL PRACTITIONERS ON PHYSICS APPLIED TO MEDICINE.

By Sir Oliver Lodge.

SUMMARY OF LECTURES V. AND VI.

HIGH FREQUENCY OSCILLATIONS.

(Continued from p. 250.)

The highest frequency oscillations known are the ultra-violet rays, corresponding to a thousand-million-million electric pulsations per second. Maxwell's mathematical theory, of 1865, showed that electric oscillations were the source of, and in fact constituted, all ethereal vibrations of the nature of "light" or radiation.

The discharge of any conductor, such as a Leyden jar, is accompanied by electric oscillation, as was shown in detail by Lord Kelvin in 1853. These oscillations in ordinary cases of Leyden jars are comparable to a million per second. With a small jar and a short circuit they may easily rise to ten million; with a big jar and long circuit they may fall to one hundred thousand per second; or if the circuit is coiled, and if the jar becomes what is more commonly called "a condenser," I have had the oscillations down to a pitch at which they give an audible note or whistle, instead of the usual crack of the spark. They can be got still lower than this, down to three or four per second, when they can be made to write their oscillating trace on Morse telegraphic paper. The *reason* of these oscillations is that electricity possesses two properties, which matter also possesses—"elasticity," or power of recoil, and "inertia," or power of over-shooting the mark. Wherever these properties co-exist, and whenever there is not too much friction or resistance, oscillations necessarily occur, and they continue until the energy of recoil is damped out by friction and converted into heat.

The whole series of oscillations, in the case of the discharge of a Leyden jar, is over and the spark completed in an extremely short space of time, the duration of a spark being often comparable to the millionth of a second; though it may easily be made longer by inserting resistance, such as a wet string: by such resistance the oscillations are killed, and the discharge degenerates into a rapid "leak," all in one direction. When two jars are used in series, making a symmetrical arrangement, the knob of one jar being charged positively, that of the other negatively, every spark between these knobs is necessarily accompanied by a rush between the outer coat-

ings, which, originally neutral, are neutral again when the rush has ceased. Whereas then the initial or A spark, between the knobs, although oscillatory, has a balance of current in one direction, representing the quantity transferred from one jar to the other, the impulsively excited rush between the outer coatings, which I call the B circuit, or B spark if there is a gap there, has never an excess in one direction—the positive and negative alternations are there necessarily equal, because the final state of the outer coatings is the same as their first state, which is not the case with the knobs or inner coatings.

Accordingly, whereas the A spark has a strong physiological effect and may easily so shock the nerves as to cause collapse, the B spark has very small physiological influence and is hardly felt. Moreover, it is not much affected by bad insulation, and can take place even under water, or when the gap is clogged with carbon, or even when the circuit is completed by a stout wire a few yards long. The impulsive rush between the outer coatings is so sudden that no ordinary leak has time to act, and even a metallic conductor offers so great an obstruction, of the nature of magnetic inertia, that the current may prefer to jump across a considerable space of air. The smallest leak across the A knobs prevents the jars from charging and destroys the whole effect, but a leak across the B knobs has no such influence.

In 1887-1892 I called attention to these peculiarities of the B spark, and described three chief classes of experiment, viz.:*

"The experiment of the alternative path";

"The experiment of the surging circuit"; and

"The experiment of the recoil kick."

The experiments of the alternative path and of the recoil kick, chiefly through the labours of M. d'Arsonval and others in France, have been now applied to Medicine.

The alternative path series of experiments consists in joining the outside coats of the jars by various conductors, together with an alternative air gap, and thus measuring the

---

* Some references to my publications on these subjects are as follows:—

Philosophical Magazine for August, 1888. Theory of Lightning.

"Mann" Lectures on Lightning and Electric Discharges in general, before the Society of Arts, 1888. Reprinted with many additions in a volume published in Whittaker & Co.'s "Specialist Series." Published in 1892.

British Association Report for Bath, 1888. Discovery of Electric Waves along Wires.

Journal of Royal Institution for March, 1889. Lecture on the Discharge of a Leyden Jar. Reprinted as an appendix to "Modern Views of Electricity" (Macmillan).

Many papers in *The Electrician*, especially between 1888 and 1890.

Proceedings of the Phil. Soc. of Glasgow. April, 1890.

Proceedings of the Royal Society, vol. 50, p. 1. June, 1891.

obstruction and effect of various conductors. A loop of copper wire or of iron wire, of a copper spiral, or a trough or tube of water, were the most customary conductors to use.

In the medical application the alternative air gap is applied to the patient, a copper spiral being generally employed to join the outer coats of the Leyden jars; from which spiral, tapping-electrodes can be taken to the patient—one usually to the couch on which he is lying, the other to an insulated electrode held in the hand of the operator and applied locally to the part required. This is sometimes technically called by operators the method of "auto-condensation."

The experiment of the surging circuit depends upon the fact that if a long copper wire is employed as a lateral expansion or linear extension of a Leyden jar discharging circuit, pulses run along it; and, if it forms a nearly closed loop with an air gap, these pulses are able to run right round it and across the gap, thus giving a spark where there is no obvious reason for a spark to occur, and where it could not possibly occur but for the momentary impulsive rush. These surgings are liable to occur in all good conductors, and exercise a most important influence on the theory and practice of lightning conductors. If iron is used instead of copper they are much less violent, being nearly killed out by the magnetic properties and higher resistance of the iron. Hence, incidentally, lightning conductors ought always to be of iron, so far as electricity is concerned. (There may be chemical reasons against its durability in some places.)

If the surging circuit, instead of being a loop, is made a straight wire ending in a knob, which, however, may be coiled up for compactness, then, in order to get the surging of maximum intensity, the length of this wire or lateral appendage to the oscillating circuit must be adjusted so as to correspond with the wave length emitted by the oscillation frequency. When this is the case, the linear conductor has violent oscillations excited in it, after the manner of Melde's experiment with a tuning fork and stretched string, and on the principle of sympathetic resonance, or what I have named "syntony." In that case, whenever the A spark occurs, the pulses set up in the lateral expansion are so violent, especially where the pulse is reflected at the free end, that a quantity of it brushes off into the air, the end being momentarily charged to excessively high potential by the rebound: constituting the experiment of the recoil kick. If the wire is very long the glows occur on it at long regu'ar intervals, representing a series of nodes and loops, thus for the first time proving the existence of waves on the wire, and enabling their length to be measured. The glow in the dark is quite visible, as I exhibited at a meeting of the Physical Society of London some 15 years ago. The potential of these brushes is not of

any one sign, but is equally positive and negative, so that an electroscope connected with it need not show any deflexion, although long sparks can be taken from it. This doubtless also is the reason why the nerves feel hardly anything when the discharge from such a knob is allowed to pass through the body to earth, although the current is by no means insignificant, and indeed under certain conditions may be very strong, so that what is passed through the body is able to light brilliantly an ordinary electric lamp; yet, being composed equally of positive and negative alternations, succeeding one another so many hundred thousand times a second, very little appreciable and no painful influence is left.

The current may be taken through the body either by direct connection or by bringing the effluvium or brush glow near the skin, or by applying a vacuum tube to the part required, or by holding a vacuum tube in the hand and letting the other end of it approach the glowing knob; the vacuum tube will then be lighted up by the current which is passing through it to the patient—a current which under ordinary cases, or, if put in the A part of the circuit, would be very strongly felt, and, indeed, would be unbearable. A current of an ampère, or anything sufficient to light a lamp, if passed through the body in one direction only, would certainly cause death.

The oscillating disturbance, which can go harmlessly through a human being, is not only able to light a lamp, but is able to pierce a solid piece of glass an inch thick, if the glass is smeared with turpentine to prevent the discharge going *round* it. It would appear as if the excessively numerous and rapid alternations worry a solid to pieces and disintegrate it, whereas on a fluid they have no such mechanical effect.

(To be continued.)

NEW INSTRUMENTS AND APPLIANCES.

One of the most telling signs of electrotherapeutic progress is to be found in the improved instrumentation that daily becomes available. We have often had occasion to call attention to the merits of electrical apparatus which, although due in the first instance perhaps to medical inspiration, could never have been brought into practical shape without the skill and ingenuity of the instrument maker. These remarks are prompted in the present instance by the appearance of the 7th edition of the electrotherapeutic section of the catalogue of the General Electric Co., of Queen Victoria Street. This is so extensive, various and detailed as to form in itself an instructive object lesson in the practical application of electricity and the kindred arts to the treatment of disease.

DIGEST OF AMERICAN LITERATURE.

ACTINIC SUNLIGHT IN THE TREATMENT OF PULMONARY TUBERCULOSIS.—J. W. Kime contributes a second paper upon this subject. After calling attention to the physical characteristics of light energy and its physiological action, he gives the following description of his method for utilizing sun light in pulmonary tuberculosis: A concave reflector, 36 inches in diameter, overlaid with blue glass, focuses a strong blue light upon the surface of the chest, made bare for two hours each day. This light is sufficiently strong to thoroughly illumine the lungs. Patients thus treated (using all other adjuvants of known value in the treatment of tuberculosis), Kime finds, respond more quickly, and a greater percentage of recoveries take place than under any other method of treatment with which he is familiar. Even cases far advanced begin to show improvement almost immediately, and from his experience he is convinced that but few cases in their earlier stages may not be permanently arrested. This statement is made from a personal experience of a number of years, and is based upon a sufficient number of cases to warrant its truth.

Since his first report Kime has removed to Denver, where he has a maximum of sunshine. There he has his skylight constructed of blue glass, but the reflectors are not overlaid with it as before.

The following is the order in which improvement occurs: loss of chills and night sweats; gain in body-weight; increased appetite; lessening and disappearence of diarrhœa if it is present; increased strength, as a rule rapidly, and ability to walk considerable distances as against short distances before; diminishing cough without the use of medicines; declination of febrile conditions in from a few weeks to two months or more, and after two or three months a return to the normal, where it remains. Bacilli are almost the last evidence of the disease to disappear, as they were also the first factor in the production of the disease. Frequently patients leave the sanitorium with bacilli still remaining, and when they return a few months later the bacilli are found to be absent from the sputum.—*New York Med. Journal and Phil. Med. Journal*, April 30th, 1904.

(There can be no question but that a systematic and scientific expenditure of light energy: (1) sun light; and (2) the electric arc, when combined with the best hygiene and sanitation, holds great possibilities in curable tuberculosis of the lungs, as well as in other tubercular conditions. Since the writer's first experience with light in pulmonary cases, there has been noted in all the literature of the subject not only the same improvement but the same order of improvement in the experience of different operators which was first noticed and recorded in the writer's cases—an improvement which, in curable cases, resulted in recovery; in incurable cases, in a relief from distressing symptoms and increased comfort while life lasted, even to the end. Such a

uniformity of experience as to the disappearance of symptoms and result would not obtain, were the agent used, other than potent for good. In the profound action of the chemical frequencies of light upon the blood, especially upon the red blood corpuscle, thereby increasing its oxygenating power, is to be found a sufficient and rational explanation of the action of light in tuberculosis. Especially true is this, where the naked chest walls or the entire nude body is exposed to the action of chemical light from powerful sources of light energy. The blood which passes and repasses in a long exposure through the illumined area, absorbs the penetrative chemical frequencies; and as absorption of light energy does not take place without work being done, the result is an impartation of a stimulus or energy to the absorbing media. The extinction of energy in space or its absorption and consequent disappearance in matter is a deep-seated fact in nature. If waves of light strike a growing plant they do work; and to this end they are absorbed all above the green. And the red medium of the blood, with its magnitude of function, upon which life depends, cannot, according to physical laws, be an exception to the law of light absorption—a law which has been abundantly proven by experimental work and clinical observation. The absorption of light energy by the living organism is a fact of great import, and in it, the writer believes, is to be found the key to read the letters of life just as the astrophysicist regards it as "the key to read the letters of the universe."—AM. ED.)

* * *

MASSAGE AND WRITER'S CRAMP.—In a discussion of writer's cramp, Norstrom maintains that a large percentage of cases is secondary to chronic myositis and that many of them may be cured by massage. He states that there are sometimes cases in which no deposits are found in the muscles, in spite of the most careful examination, and that there are others, although exceptional, which cannot be cured by massaging the deposit. Of 47 cases treated by Norstrom, muscular inflammations were found in 34, and nothing in the remaining 13. Tremor was present in a greater or less pronounced degree in the majority of cases. According to Norstrom massage is the only treatment applicable to the affection. It must be applied to the muscular inflammations. The necessary manipulations are *effleurage* and suitable frictions. Two cases are reported in detail.—*New York Med. Journal,* March 12th, 1904.

(That massage is of value in the treatment of writer's cramp does not, to the writer's mind, admit of question; but that the condition is one of myositis, as a rule, does. The consensus of opinion to-day regards it as a local neurasthenic state, and very apt to be found in the neurasthenic patient.—AM. ED.)

PART II.

PROCEEDINGS OF THE BRITISH ELECTROTHERAPEUTIC SOCIETY.

Edited by CHISHOLM WILLIAMS, F.R.C.S., Ed.

The Twenty-third Ordinary Meeting was held at 11, Chandos Street, Cavendish Square, W., on Friday afternoon, the 24th June, 1904. The Vice-President, Dr. DONALD BAYNES, occupied the Chair.

Present:—14 members and three visitors.

Dr. SAMUEL SLOAN (Glasgow) showed some special electrodes.

Everyone familiar with electrotherapeutic treatment must have been struck with its beneficial effect on the general health in cases in which the electric applications are directed towards local conditions only, and therefore one is not astonished to hear a patient ask during the local application of electric currents for the relief of hæmorrhoids, for instance, if this treatment is meant to make one "more fit, as it seems to be doing this." Especially with high frequency is this the usual result. Notwithstanding this, however, the most powerful effect is a local one in such cases. Therefore the mode of action and the kind of electrode employed are important considerations. Now, in consequence of the comparative lateness of this form of electric treatment, there has hardly been time to design suitable electrodes for its many forms of application. Many engaged in this practice must have wished for a large number of electrodes to select from, though considerable progress in this direction has already been made. This must be my excuse for bringing these new electrodes to your notice and for your criticism. That they are capable of being improved I am certain, but even in their present form they have given me satisfaction.

The first one I show you may produce a smile at its homely appearance and its evidently slight cost. It is simply a double flexible cord of numerous fine strands of wire, with the insulating material removed near one extremity to the extent of about six inches, and with a sufficient length beyond to permit of its being held in position by the clip of the X-ray stand. The strands are at the part exposed twisted together and some fuse wire is wound round this part to give it sufficient rigidity and to increase the surface for emission of the effluve. I have found, however, in a sufficient

number of cases to justify me in showing it to you, that its value is inversely proportioned to its cost. It is meant as a neck electrode in cases of pharyngeal and laryngeal catarrh: such cases indeed as the laryngologist has often to treat; with usually more patience than success. In these cases there is a morning cough and a morning spit. Sometimes alcohol and tobacco are the causes; often the nasal passages are at fault; sometimes it may be gastric in origin. But, whatever the cause, the fauces have always a congested appearance, and gargles, sprays, internal treatment, etc., are of little avail; whilst the surface affected is too extensive for the galvanic cautery to be of service. Such patients go from one throat specialist to another, till they finally give up treatment in disgust. Amongst the cases, mild and severe, which I have treated by this means and with quite satisfying success, one occurs to me which it may be worth while giving brief notes of. This gentleman had a severe attack of congestion of the lungs about 10 years ago, with an almost constant cough since; a slight cold sufficing to induce crepitation at the bases of the lungs, most chronic and intractable, though not sufficient to keep him from business. No medical treatment had any effect, but a local application of the effluve from the resonator produced so much improvement in the physical signs and in the cough that I was quite delighted with the result. The gentleman himself was equally pleased, though his wife would not admit that his morning cough and spit were at all lessened. Concluding that her statement might have some element of truth in it, and considering that, though the pulmonary condition had undoubtedly improved, the congestion of the fauces still remained, as did also the morning cough and spit, I consulted Dr. John Macintyre as to the treatment of the throat catarrh. He said it had become so chronic that he could think of nothing likely to benefit it, though it might be worth while giving him the auto-condensation, and, during the application, drawing off a brush discharge with my fingers from the front and sides of the neck. Partly to save myself the trouble, however, and as more likely to prove efficient, I prepared this electrode, the effluve from which covered the entire surface of the neck and confined itself to that surface better than any electrode I had previously tried. The result was such as to cause his wife to volunteer the remark, that there could be no doubt now as to the improvement. The cough and spit were less than for years. About 20 applications in all had been given. The insulating rubber tubes at either end permit of its proper adaptation by the fingers whilst the effluve is in action.

This rectal electrode (figure 1) I consider an improvement on the ordinary hæmorrhoidal one. The latter lies in the ampulla of the rectum and has the slender rod of the handle

passing through the anal canal. Now, the hæmorrhoids are often in the anal canal, or just within the external sphincter, and this new electrode presses on the whole anal tract, being gripped between the inner surface of the internal and the outer surface of the external sphincter; the distance between the two bulging portions of the electrode being about 2½ c.m., which is the length of the anal canal. I use it alone now in the treatment of hæmorrhoids. I am wishing, however, to draw your attention to it as a specially useful form of the electrode in the treatment of a certain form of constipation, namely, that due wholly to an atony of the muscles of the ampulla of the rectum. In such cases the muscles of the abdominal wall can force the contents of the rectum down to the stretched anal outlet but no further. Possibly the abdominal muscles are in part at fault, but I believe the fault is mostly due to the state of the muscles of

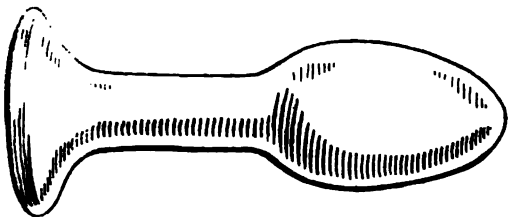


Figure 1.—Rectal Electrode. Nat. size.

this middle portion of the rectum. Now, since the thick longitudinal bands of the muscles of this part of the organ are mainly exercised in the process of expulsion, and as these bands terminate between and amongst the fibres of the two sphincters, the advantage of the pressure on this part by the thick neck of the electrode will be obvious. This form of atonic constipation seems to me to be more common than is generally recognised; the atonic state of the colon and of the sigmoid flexure alone being, as a rule, considered at fault. Of late, however, I have come across several cases where, either on odd occasions or as a chronic condition, the atony is mainly, in many of the cases wholly, ampullar. This is, in my experience, more common in women, though not confined to them. Frequently digital compression from the vagina is necessary to empty the ampulla, and this can often be done without soiling the fingers in the slightest degree. This condition, if at all severe and occurring frequently, causes great mental depression and no little physical pain, and thus warrants special consideration on the part of the medical attendant. I have no doubt that many forms of electric

treatment will benefit this condition, but the use I have put this electrode to for this form of constipation has proved in my hands so successful, that I should like to say a few words further on it. Normally no fæcal contents should be tolerated in this urid portion of the rectum, although anyone engaged in gynæcological practice must often have found the reverse to be the case. The normal irritability of the part has, however, in these cases been destroyed, and the muscular response weakened, no doubt largely on account of the frequent necessity for overcoming the solicitations of nature as well as from the drug habit which probably acts by preventing the natural lodgment of solid matter in the rectum. It is well to recognise this form of constipation, for I believe its successful treatment by electricity to be assured, especially if a course of strychnia and sulphate of magnesia be combined with the treatment, though without the electric part of the treatment the medicinal will prove quite or nearly useless. The form of electric application I have found most beneficial is the slow static induced, causing rythmic contractions of the muscles of the rectum and of the abdominal wall ; a large clay electrode being applied over the latter. The abdominal muscles are of importance, no doubt, in these cases, and they are strengthened by this treatment, but anyone engaged in obstetric practice must have observed how ineffectual in labour are the abdominal muscles if the uterine are not contracting normally even in the second stage of labour. I have tried the ordinary faradic current, the slow sinusoidal alternating, the bipolar high frequency from the solenoid, and also from the resonator, with a finely graduated spark gap in series with the patient. The former two are slow in effect, and the latter are uncertain in action ; giving at one moment no muscular action, and then suddenly one of tremendous energy, though no change has been made in the length of the spark gap or in the amount of current supplied to the primary of the coil. I have had every satisfaction, however, from the recto-abdominal application of the static-induced current ; employing a length of spark gap sufficient to produce about 200 muscular contractions per minute, which means with my machine about 4 m.m. These are quite appreciable by the patient, cause no nervous excitement, and are quite painless. In one of my cases the affection had been so troublesome, enemata and internal medicines having had no effect in relieving the rectum of its contents in spite of powerful abdominal straining, and the result of the treatment had been so gratifying to the patient that when I suggested that the treatment would not now be required as often as once a week, the lady begged of me to continue as long as possible, since she would grudge no trouble to ensure a permanent cure. The advantage of this electrode in such cases is that, whereas the ordinary rectal electrode, lying

loosely in the ampulla, was apt to excite the levator ani muscle unpleasantly, or to set in action the psoas and iliacus muscles of the side towards which the electrode was leaning, whilst its action was variable, this electrode, on the other hand, pressing firmly on the muscle to be acted upon, and being gripped firmly in the anal canal, removed these difficulties. A pad placed under the sacrum may sometimes be required, but this is unnecessary, as a rule, even when the patient is in the dorsal position. The electrode is screwed into the ordinary hæmorrhoidal electrode handle.

The beneficial effect of this treatment is generally evident during its continuance; but if the case is very chronic the good result may be delayed. The following case in illustration of perhaps the severest type of the affection possible to meet with illustrates this.

A young woman came to me some years ago with this complaint. She could get no natural movement of the bowels. The rectum had always to be emptied mechanically by covering her fingers with paper and digitally emptying the organ. At that visit I gave the strychnia, and sulphate of magnesia mixture; but about three months ago she returned, saying she had derived no benefit from this treatment, that no medicines could be got to empty the bowel, and that she had to give up her situation, owing to the effect of the condition on her general health. After 12 applications of the recto-abdomino slow static induced current, the treatment was stopped. It had had absolutely no effect on the case. I wrote to this girl, however, a few days ago, and in her reply she says: "I am keeping a great deal better now, I never feel the weakness I complained of in my legs. The bowels are not quite right yet, but I have a natural movement about three or four times a week. I am in a situation now, and feel able enough to do my work."

I cannot imagine any kind of treatment other than this which could be of service in such a case as that related.

Vaginal Electrodes for High Frequency Currents. — I show you two such, which I have been using; one for the cervix uteri to rest on, in cases of chronic metritis or sclerosis of the cervix, or in uterine fibromyomata; the other (figure 2), for lying in Douglas' pouch. The shape of the latter enables the cervix to keep it in position. I have used it with satisfaction in cases of cellulitis, ovaritis, and, where the uterus is slightly retroverted, in salpingitis; and with better results than I had previously obtained by the faradic current or the sinusoidal. The application may be monopolar or bipolar, the amount of current being generally about 100 milliampères.

The last electrode I shall ask you to look at is an eye electrode made of boxwood for using with the static breeze. You

will observe that it is long, and is pointed at its termination. It has, round the point, a protecting glass cup, without which there would be danger of wounding the eye, since the room is darkened during the application. I have used this in eye strain, where even correct glasses are insufficient to remove the eye-ache. It can be used as a sedative or as a stimulant, according to the length of the spark gap; the positive pole, to which the electrode is attached, being earthed. Or, if a still more sedative action is desired, a chain may be attached to the electrode with the other end of the chain lying on the carpet, besides having the length of the spark gap very short. The glass cup is coated with shellac, to prevent the electric stream from rushing on to the cheeks and nose; and, where the wood passes through the cup, grooves are cut in the wood to permit the current to pass. I have used this electrode in four cases only; but it promises to be useful. In one case especially it gave great relief, after other electric applications had failed.

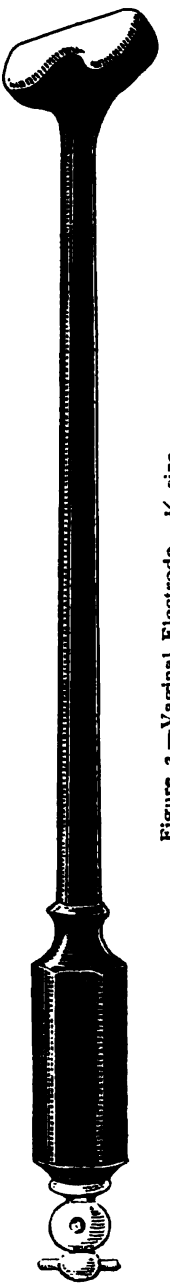


Figure 2.—Vaginal Electrode. ½ size.

Dr. SLOAN also read notes of an interesting Case of "Cancer en Cuirasse."

The enthusiasm, which hailed X-rays as a cure for cancer is, I think, now giving place to serious doubts as to its value in this disease, unless in cases of superficial carcinomatous ulceration. Malignant tumours, internal and external, are recorded as having been removed by this treatment, and for this there is great reason for thankfulness and for hope. Fortunately there are varying degrees of malignancy. If, however, X-rays are sometimes capable of removing or diminishing genuine carcinomatous tumours, I should like to ask if anyone here has had a case of even superficial secondary carcinomatous deposits, which he has seen benefited by the rays. No such result has at any rate followed in the case I am about to relate, in spite of prolonged, faithful and, I hope, careful application of these rays. In this case,

as I shall show, these deposits grew more rapidly where the X-rays had been applied, although no dermatitis had occurred, and even during the healing of the ulcerated surface. Improper application of the rays can, therefore, hardly be alleged as a cause of this continued growth.

Mrs. H., age 46, consulted me on 6th January, 1903, for extensive carcinomatous ulceration of the chest wall on the right side, there being an entire disappearance of the right mamma. The ulcerated surface, measuring 4¼ inches by 3½ inches, was closely adherent to the chest wall, the edges were sharply punched out, partly circular, elevated and hard, and there was a constant discharge of a "mattery water." There were several secondary nodules round the ulcerated surface, some of them whole, some ulcerated, especially in the axilla, some of which were excavated, the edges being cracked and liable to bleed. There was also a chain of nodules running down the scapular surface and several scattered over the rest of the chest wall. The right arm was œdematious as far as the elbow. The pain had not been acute—more a constant soreness—and the general health was fair. She informed me that the disease began four years previously and, although Professor Macewen, when consulted, had advised removal of the breast, no treatment whatever was adopted. Electric treatment was at once commenced in the form of the static breeze, a spark gap being employed. Within three weeks the half of the ulcerated surface was covered with healthy new epithelium. Where cavities existed these were filling with healthy granulations, within which islets of pearly, young epithelium seemed every day to start and form connections with the epithelium near the edges of the ulcers. This went on without any flattening of the edges, and sometimes with the surface of the ulcer considerably excavated; not like the simple ulcer which refuses to heal until it is exactly on a level throughout with the surrounding skin. Some of the ulcerated nodules would sometimes become covered with a dry, glazed film, as if an attempt were being made to cover them with epithelium of a sort before they were properly prepared for normal healing. These ulcers, however, did not retain their glazed covering for any length of time. This satisfactory progress continued till 18th February following; when a slice was taken off one of the nodules for microscopic examination. Dr. Leslie Buchanan, to whom I sent the specimen, reported as follows: "Probably the original growth was scirrhous carcinoma of the breast, and the tissue sent to me is part of a secondary nodule." The surface left after removal of this slice of tissue became very foul and there was great pain in it. In consequence of this septic inflammation a large portion of the young epithelium from the

already healed part separated, and the healing process had to be started afresh. Not till 8th April was the ulcerated surface again covered with healthy epithelium. But the cavities were filling up in a very satisfactory manner. By 21st May the disease had increased in the sense that more nodules had formed and those previously there were larger. It became evident that the static breeze, whilst quite capable of healing ulcerated surface arising from broken-down nodules, was incapable of benefiting the nodules themselves, unless to the extent of hastening the removal of the sloughy tissue from their surface and thus permitting the formation of new epithelium. Having come to this conclusion, I began the application of X-rays. The result was practically the same as from the static breeze, there being steady progress in the process of healing of the ulcerated surface. In about three weeks, however, without any warning, the new epithelium became stripped off, and the whole surface became covered with a dirty grey membrane. There had been no change in the tube used, in the ampèrage, or in the manner of using it. The tube was one of medium hardness: the quantity of current supplied to the primary was two ampères, and the distance of the tube from the patient remained about six inches, the time of exposure being 15 minutes. When healing had been again completed I made an attempt to get a tube that was likely to cause dermatitis so as to break down the nodules, and succeeded in getting one with a bad reputation for this, though in all other points quite an ordinary tube. This one was used once only for six minutes on 17th January last, two thicknesses of lead-foil being employed to protect the healed surface. During most of the exposure pain was complained of, though the patient had never expressed herself as suffering from pain from previous applications of the rays. This pain lasted all the rest of that day, and the following day there was extensive sloughing beginning on several of the nodules, notably on those uncovered by the lead-foil. Over the previously healed part several deep ulcers soon formed, covered with a dirty grey membrane. These, however, soon began to heal. There has never been any scar-like tissue, nor any traction on the surrounding skin, and the boundaries of the previously ulcerated part are now on the level of the surrounding skin, it being scarcely possible to tell where the original elevated edges were. Patient suffered constitutionally from this last application of the rays, the tongue becoming coated with a thick yellow fur. A course of quinine and grey powder considerably improved matters, and a tonic afterwards of nitro-muriatic acid and cinchona left the patient practically as well as before this destructive action began. The process of separation of the sloughs was slow, and for some weeks no electric treatmen

was attempted; but no resumption of the healing process took place till a renewal of the static breeze treatment, when, almost at once, patches of new epithelium began to form over the whole of the ulcerated portion free from broken-down nodules, and this healing process is rapidly advancing.

At the request of the patient the rays were again applied, but unless where a specially thick layer of lead was used some sloughy ulcerated patches appeared on parts quite healed over previously, though the original tube had been employed. I mentioned that several nodules were scattered over the scapular region at the onset of the electric treatment, and what surprises me is, that whilst those on the part where the X-rays were applied have advanced and new ones have appeared, not only have no new nodules formed posteriorly and no advance has taken place in those previously there; but these have, in the opinion of the patient and of myself, become smaller than they were 18 months ago, when first noticed. Is this evidence that the electric saturation of the patient during the X-ray and static applications has acted beneficially on the nodules not exposed to the X-ray influence? My inference is that, in this case, the static breeze has as great an influence on the repair of the carcinomatous ulceration as the X-rays, is more reliable, is more soothing, and is less likely to cause increase in the growth of the nodules or to produce a necrotic change in them. This general electric saturation may also account for the fact that the health of the patient has been wonderfully good during the treatment. The œdema of the arm has, however, advanced with the spread of the nodules and with the breaking down of these. I shall be glad to hear the experiences of anyone who has treated carcinomatous ulceration with secondary nodules by means of the static breeze only, or by general high frequency treatment only.

Dr. COWEN congratulated Dr. Sloan on his interesting paper. He was especially interested in the careful and honest account given of his case of cancer. He did not see how it was possible to compare the static breeze with X-ray in the treatment of any form of cancer. The two were so essentially different in their action that such a comparison was hardly conceivable. While undoubtedly the static breeze had a very marked influence in promoting the growth of epithelium over a denuded surface, yet this was not the action necessary for the "cure" of a malignant tumour. It was the power which the rays have of bringing about a degeneration of the cells of the new growth leaving the healthy stroma uninjured which we sought to use in treating a cancer case. He could not agree with Dr. Sloan that except in very superficial cases the rays were a failure in the treatment of cancer. Personally he was very keen on the X-rays in cancer, and though he had

plenty of failures he did not blame the rays for this, but rather he attributed it to his having failed in getting the factors of the exposure correctly proportioned. Where a case did not improve under X-ray exposures it was his custom to vary each one of these factors until he found that the effect he desired was being produced. The ampèrage and pressure of the primary current, the nature of the interrupter and its speed, together with the character of the tube, the distance from the target of the surface exposed and the length of exposure, each had their definite influence on the final result, and he was confident that in cases which appeared to be failures it would have been possible to hit upon just such a combination of these factors which would have produced a favourable result..

Dr. DONALD BAYNES said he was sure those present were all greatly indebted to Dr. Sloan for his admirable and practical paper. The high frequency current electrodes are most ingenious, and he hoped that on sending his paper to the Journal, he will at the same time let the Journal have blocks of these electrodes, so that cuts of the same may be introduced. He quite agreed with Dr. Sloan, that a marked improvement of the general health is noticeable where high frequency currents have only been used locally for local affections, thus showing that even purely local applications have a distinct beneficial effect on the general nutrition of the patient. Among the electrodes shown by Dr. Sloan this afternoon, the flexible neck electrode for the treatment of diseases of the throat and nose and the rectal electrode struck him as being a distinct advance on those now in use. In regard to the eye electrode for the static breeze, he should have thought if the centre pin in the glass eye-cup was so arranged that it could be advanced or withdrawn at will, it would be more convenient, as in this case the necessity of moving the electrode backwards or forwards would be obviated. Dr Sloan's cases of cancer are most interesting, and he should be glad to learn if Dr. Sloan has compared the results obtainable by metallic electrolysis with the methods he has just described ; and also what results he has had in uterine and nasal diseases with soluble metallic electrodes.

Mr. CHISHOLM WILLIAMS was particularly interested to note that Dr. Samuel Sloan obtained the best results with the combined application of X-rays and general electrification. In his hands he had found the high vacuum electrode used from the top of the resonater to be the most effective treatment for recurrent cancer. The high vacuum electrode must give off an abundance of X-rays. Malignant growths with glandular infection had not in his hands derived much benefit, except for the relief of pain, and for in some measure diminishing the offensiveness of the discharges.

Dr. SLOAN, in reply to the Chairman, explained that the eye electrode can be held closely against or at a slight distance from the eye, according to the comfort of the patient and the amount of the smarting.

In reply to Dr. Cowen, he said he feared that the only "breaking down" of secondary nodules by X-rays was by necrosis, not by absorption. He assured Dr. Riddell that the damage done after the use of the tube, which was applied once only, and for six minutes, was no mere coincidence. The pain during the application had been too severe, and the destructive action had followed too closely to have been due to previous applications of the former tube. Moreover, this new tube had been well known as a dangerous one.

In answer to Dr. REID, Dr. Sloan said that the electrodes had been made under his directions by Baird & Tatlock, Glasgow.

The Meeting then concluded.

ANNUAL DINNER.

The annual dinner was held at the Trocadero on the same evening. Dr. Lewis Jones occupied the Chair, and was supported by 30 members and guests. Messrs. Louis Schneider, Marshall Vincent and George Robbins contributed an excellent musical programme.

NOTICES.

Members taking part in discussions or making remarks on papers, etc., are earnestly requested to give their notes on same to the Secretary at the end of evening, so that the proceedings may be complete and not delay the prompt publication of the Journal.

PUBLICATIONS.

17.—The proceedings shall be published in such a manner and at such times as the Council may direct. A copy shall be forwarded to each Honorary and Corresponding Member of the Society, and to every Ordinary Member whose subscription is not more than one year in arrear. Fourteen days' notice should, whenever possible, be given to one of the Secretaries by any member who wishes to show a clinical case or to make a communication to the Society. A copy of the paper in a form fit for publication in the proceedings must be furnished at the same time. The paper shall be the

property of the Society for publication in the proceedings, without prejudice to the author's right to reprint or insert in any recognised medical paper or periodical. In all such cases the author shall state that the paper was read before the Society.

Members are reminded that the annual subscription (one guinea) became due January 1st, and should be sent to either Honorary Secretaries at their earliest convenience.

In July a business meeting will be held at the Oxford Meeting of the British Medical Association, date will be announced later.

On October 28th Dr. C. A. Wright has kindly promised a paper.

On November 25th Dr. Gamlen has kindly promised a paper illustrated with lantern slides.

In December will be held the Annual Exhibition.

PHOTOTHERAPY.

Dr. Julius Rosenberg collates a number of cases, in reviewing his experience with phototherapy. He is of the opinion that in Light a remedy of no mean order is to be had and one which in the near future will occupy a most exalted position, the possibilities of the curative action of which are still unknown.

For a source of energy he uses a 55 ampère iron carbon arc He regards the high ampèrage necessary, the specially prepared carbons also necessary. The divergent rays are collected by the mirrors of the apparatus, enabling him to throw and concentrate the light upon a given point. Exposures from 55 to 75 minutes : a shorter application he regards as not of lasting benefit. In a sensitive skin the expenditure of so great energy and one so rich chemically over as prolonged periods may produce erythema, but with ordinary care he does not find that it either produces blisters or other injuries. The treatment as a rule is not only not unpleasant, but affords relief from any pain from which the patient may be suffering, and is therefore gratifying both to patient and physician.

Rosenberg reports 20 cases as follows : Neuralgia in right breast, seven weeks' duration—usual classical treatment, recovered under two applications of light, duration 55 minutes. Severe neuralgic pains originating in left ovary in patient five months pregnant, locomotion difficult and painful—relieved entirely by two light treatments. Intercostal neuralgia, four years' duration,

constant pain, varying in severity—treated by Rosenberg for years with but little relief, disappearance of pain after third treatment by light, no return after two months. Coccydynia, from traumatism, miserable for a year, unusual tenderness at sacro-coccygeal articulation, no abnormal condition of rectum or genitals—relieved considerably after first treatment, free from pain after two weeks' treatment.

Ovarian neuralgia left for years the organ enlarged and tender—local treatment, tampons, etc., without much relief. Patient relieved by first treatment. Apparently cured after five exposures; ovary smaller and no longer sensitive. Injury five years since, patient fell upon buttocks, since pain and tenderness in lumbar region, especially left side, very miserable last summer, spasms of erector spinæ, producing temporary spinal curvature; massage and continuous current of no benefit, seen in consultation by nerve specialist who advised Paquelin cautery to be applied and rest in bed. Slight improvement resulted, but patient never free from pain. Pain much worse three weeks previous to report; considerable distortion of the spine, unable to turn in bed as the slightest exertion caused extreme agony. Relieved by first treatment, and after five treatments the patient was free from pain and able to be about. The remaining 13 cases were a sciatica of several years' duration, apparently cured after nine applications; neuritis musculo-spinal, four months' duration—all remedies tried, morphine in ½ gr. doses gave transitory relief; completely relieved for eight hours from first exposure, and went to sleep for the first time in weeks without opiates; 12 exposures in all, and at time of report able to attend to business, no longer using opiates and with the exception of a slight rigidity no pain nor discomfort. The remaining cases are of much the same character and were relieved with the same celerity. Two cases of *tic douloureux* and one of chorea will serve to complete a very interesting clinical report.

Mrs. —, a facial neuritis of six years' duration, untold agony, most of her teeth have been removed, also her lower jaw bone. First seen five weeks prior to the report, could hardly speak, every movement of the jaw painful, sharp shooting pains—a typical picture of *tic douloureux*. The first treatment produced a wonderful change in her condition, she left the office free from pain, and a treatment every third day had kept her comfortable. She sleeps without opiates and is able to receive the much needed care of a dentist. The case was not regarded as a cure, but in a few weeks, even days, results had been obtained which years of medication and operations had failed to secure. Mrs. S. F., *tic douloureux* for ten years, division of the nerve at various points afforded none or only temporary relief. Applied for treatment, by advice of family physician, in the greatest agony. Temporary relief from exposure to the light, but pain returned with undiminished severity whenever the light was removed. Treatment discontinued after the third treatment, on advice of a nerve specialist, who stated (?) that the treatment if continued would cause burns and brain injuries.

In a boy of ten, twitching of facial muscles since infancy, the spasms had almost entirely ceased after seven exposures, the light

being directed to the occiput. Neither cure nor improvement was expected, and Rosenberg states that had the boy been an older subject, the probability of hypnotic suggestion might have been considered.—*New York Med. Journal and Phil. Med. Journal*, April 23rd, 1904.

Remark.—These detailed cases of Rosenberg's are corroborative of the writer's experience with the electric arc for the past 10 to 11 years. Recently concentrated and condensed light, deprived of all the thermal frequencies has been used succesfully (1) to relieve extreme cerebral congestion, one application ten minutes in duration made to cervical cord with compression ; (2) localized pain and soreness as a sequence of spinal hæmorrhage, with complete paraplegia, one application 10 minutes in duration ; and (3) in severe neuralgia involving all the nerves of right side of neck, face and occiput secondary to mastoid congestion following grippe, one exposure five minutes in duration. The painful area in the case of spinal hæmorrhage was relieved at once. The case of cerebral congestion, slept all night after the treatment for the first time in many weeks, and returned to the office the following day with lessened circulatory disturbance (had typical belladonna face and great mental confusion), quiet mien and consecutive thought. In the case of neuralgia, the application was made just behind the ear. An erythema developed in 20 minutes, increasing in severity for 24 to 36 hours, and the sensation was that of a burn. During this reactionary stage the suffering was increased, the sensation being that of extreme congestion and as though every nerve, trunk and branch was held in a vice. With the subsidence of this stage, improvement began and has been continuous. The severe supra-orbital, ocular, and aural pains have passed and do not appear under the influence of cold, damp and fatigue as they did formerly, while the neck muscles, which were not only sore but rigid, are practically normal. The relief has continued for the three weeks since the exposure. The evidences, *i.e.*, increased pigmentation of the action of light; has not yet disappeared. Exfoliation took place in about 10 days. An exposure to the entire body in a cabinet has been found very valuable in neurasthenic patients. There is undoubtedly a field of very great usefulness for the use of light in functional nerve disorders, and Sterne* in his sanitorium work states that the light treatment of locomotor ataxia has yielded him better results than other methods, all of which he has faithfully tried. The electric arc was used by Sterne as well as by Rosenberg and the writer. Other than the action of the chemical light frequencies on the blood there must be an immediate action upon the peripheral nerve endings, judging from the prompt and speedy relief from pain.

There is yet a very great field for study and observation in the investigation of the action of light energy. The fact of absolute dependence of the human species for existence upon the radiant energies of the sun presupposes a definite relation between its action and the functions of the living organism.—AM. ED.

---

* *Journal Am. Med. Ass.*, Feb. 24th, 1904.

MEDICAL

Electrology and Radiology.

No. 8. AUGUST, 1904. Vol. V.

EDITORIAL.

The importance of the discovery made by Becquerel of radio-activity can hardly be overestimated. It has revealed to the prescient eye of Science a vista of possibilities hitherto undreamed of, or erstwhile regarded as foolish vagaries of the imagination. It has shown how extensively must many theories, now current, be modified—if not entirely remodelled, in the light of future discoveries—if they are to shadow the advance of knowledge. It has presaged the application, in the immediate future, of physiurgic agencies, not only to the cure of diseased conditions but also to their hygienic prevention. Conservative Medicine, true to her traditions and regardless of the fact that the medicine bottle is fast ceasing to be the devote object of popular worship, still halts to babble of the vast potentialities of her pills, draughts and potions, or to bleat a vain regret for the palmy days when the special requirements of all cases could be summed up in the short formulary—drugs, and resignation to the decrees of Divine Providence! The vast and ever-increasing inroads made by Surgery in what has hitherto been regarded as the legitimate domain of Medicine, clearly proves that the sister-art is not satisfied to stop thus at the threshold of progress. No region of the body is now taboo to the knife of the surgeon, and no disease does he consider as outside the limit of his adventurous aid. Many a hideous caricature of the human form divine survives, both to attest his skill and to bear witness to the futility of drug medication, and the pressing need of some more æsthetic cure than that which the barbarous knife affords.

Meanwhile, the gospel of Physiatrics has been sedulously preached, and has made many converts, who, casting aside

all selfish recollections, admit that an ample measure of success has been already achieved. Hitherto public attention has not passed beyond Open Air and Direct Sunlight as a curative formula, nor has the purview of sanitary science extended beyond questions of ventilation and individual air-space. But now the possibility of assimilating the Air of our climate to that of other regions known to be beneficial to particular diseases, and to modify it to suit individual requirements, is upon the tapis. That such a treatment of the Atmosphere is a practical possibility, and that this can be accomplished by means of physiurgic agencies, is becoming known to men of science. If the profession at large have hitherto been content to glean rather than reap in the fields of science, and catch here and there a seed that may fructify under their fostering care, still, it must be admitted that even in their midst an organization exists for combining a study of pure science with that of its therapeutical indications, and thus equipped, to endeavour by systemic collaboration to solve some of the problems which are beyond the unaided powers of the medical art. They have summoned to the aid of the sick, Air (compressed, rarified, dry, moist, oxygenated, ozonized, medicated with steam, vapours, and even rendered radio-active by emanations from thorium and radium); Heat (dark and radiant); Light (red, blue and violet, together with the other visual, and infra and ultra-visual radiations), as well as the Röntgen and Becquerel rays. The physiological effects of electrical currents—continuous, interrupted, alternating and oscillatory—have likewise been studied to afford a sure basis for a rational system of physiatrics. Do not these facts justify the hope that when the real nature of the work is better understood, and its actualities revealed by closer examination, the Universities and Colleges of Great Britain will accord it an ample measure of support by the institution of a Degree or Diploma in Electrotherapeutics.

LECTURES TO MEDICAL PRACTITIONERS ON PHYSICS APPLIED TO MEDICINE.

By Sir Oliver Lodge.

SUMMARY OF LECTURES V. AND VI.

HIGH FREQUENCY OSCILLATIONS.

(Continued from p. 298.)

Although the effluvium has no effect on the skin beyond a slightly warming and pricking sensation, yet if the skin is broken, as by a cut, it has a more smarting effect, probably because this part is then a better conductor, so that the effect is more concentrated; there is always some liability to sensation when the discharge is concentrated at a point instead of being spread over a reasonable area.

The recoil-kick method is often employed for obtaining the brush discharge or effluvium, or high-potential high frequency, such as is applied locally for lupus and the like. The alternative-path form of experiment, or tapping-electrodes from a copper spiral, is also employed for the same purpose; but in general the potential is less with this method, whereas the current or quantity sent through may be stronger.

The discovery that the current thus tapped off from a continuous Leyden jar circuit excited by a powerful coil was more than sufficient to light a lamp, and at the same time could be sent through a patient without injury, was made by Dr. d'Arsonval.

In 1894 an experiment was exhibited to the British Association at Oxford by Professor Gotch and myself, showing the influence of the alternative path or B circuit sparks on a frog's nerve-muscle preparations. We had found in Liverpool that the strong influence from two points on a copper wire in the B circuit when applied by electrodes direct to a frog's nerve had no motor influence, provided precautions were taken to prevent any current more in one direction than in another, although sparks $\frac{1}{16}$ in. long could be obtained between the applied needles. Nevertheless, if to those same needles, or to another pair higher up the nerve, a tenth of a volt were applied in one direction, as by a fraction of a zinc-copper cell, the muscle twitched vigorously, writing its record on a drum in the usual way. By arranging a clock to make contact at every second, a succession of twitches were maintained in the usual way, and at the same time the B circuit high-voltage

high-frequency disturbance was applied, taking all due precautions such as thoroughly sound metallic joints, and earthing of the mean point. At first nothing happened with each spark of the oscillating circuit, but gradually the nerve became paralysed or clogged by them and ceased to respond to the low-voltage stimulus, so that the trace on the drum gradually decreased and ultimately ceased, as if either the nerve or muscle had been fatigued. The effect was not due to fatigue of the muscle, and fatigue of nerve is unknown; it was either a paralysis or a choking of the nerve of a temporary character. For, letting the B disturbance now cease, while the clockwork contact-maker continued going, the nerve presently recovered and the muscle began to twitch as before. Thus it may be expected that these rapidly alternating currents, if long continued, gradually suspend for a time the activity of the nerves —in this case of the motor nerve—but produce no other effect; though, indeed, if they are *too* strong, they can excite tetanic convulsion. It has been asserted by M. d'Arsonval and others that the same choking or paralysing action occurs on the sensory nerves, and that accordingly it may be possible to render a limb anæsthetic by subjecting it to high frequency oscillations for a long time. I have never experienced this, and am unconvinced of the truth of the assertion, which I have only seen quoted and not responsibly made. I do not doubt that it would occur if the oscillations were applied to a nerve direct, as in the frog's nerve-muscle preparation they are; but when the nerves are embedded in tissues, it is extremely difficult to know by what path the currents go, and I am not prepared to say what effect they then have upon the nerves embedded in those tissues. There is a feeling, however, which I have so frequently had after dealing with alternating currents that I think it cannot be imaginary, and my assistants have felt it likewise, viz., a feeling of undue languor or depression and fatigue. I have not noticed any permanent injury; but whereas we used to take these currents through our body pretty frequently, we are now more chary of doing so, not because we feel any effect at the time, but because of the singular sense of nervous lassitude which afterwards follows, and which I have been careful not to emphasise hitherto in order to minimise any influence of suggestion. I have become, however, more convinced recently of the objectivity of the sensation, and hence state it here, not as an ascertained fact, but as a hint to experimenters and practitioners.

One of the effects of the effluvium of the brush discharge which accompanies many of these experiments, and especially the recoil-kick experiment, is the production of ozone, and I have never found that ozone has a good influence. I have suspected it many times of producing something akin to catarrh or inflammation of the nasal mucous membrane. I

would suggest strongly that inhalation of ozonised air is dangerous, and that experiments in this direction should proceed with extreme caution. I think that the general public is afflicted with superstition about ozone.

About 1896 Tesla applied to the B circuit copper spiral a fine wire secondary circuit wrapped round it, in order by "transforming up" to get still higher potentials. In this he was very successful, chiefly by the use of oil insulation to separate the coils; and a series of most interesting experiments on the lines of the recoil kick, but much intensified, resulted. These high frequency and very high potential discharges or brushes from the Tesla coil were at first applied in Medicine, but they have been gradually found too intense and difficult to manage; and I was interested to see, on visiting Mr. Hall Edwards, that in the most recent practice they had been abandoned, and that the ordinary B circuit, without any secondary winding, was employed for medical application, very much on the lines of my old experiments, but developed and made convenient by the work of Dr. d'Arsonval and others in France. Mr. Hall Edwards was good enough to ask Mr. Cox, the well-known instrument maker in London, to lend me the latest pattern of high frequency apparatus, and this is what I have exhibited. In this apparatus the A spark, if not enclosed in a box, is very noisy, and if enclosed in a box it generates nitric oxide fumes, which spoil the insulation and injure the metals. The box should therefore be ventilated—preferably into the chimney or other exit. A blast of air on an A spark strengthens the B effect considerably, by blowing away a conducting effluvium and so increasing its suddenness.

Although Tesla coils seem now discarded, one inductive effect is employed in Medicine, viz., what is called by operators "auto-induction." J. J. Thomson showed that by putting an exhausted globe inside the copper spiral of the B circuit in which the oscillations were occurring, an induced current was excited in the globe, giving a luminous ring—a circuit complete in itself, hence called "auto-induction." The human body can be substituted for the exhausted globe, and if the human body is placed inside such a spiral, currents are necessarily induced round and round in the body itself. This arrangement has also been introduced into Medicine by d'Arsonval, and a large vertical copper spiral is usually found in French medical installations. It does not appear to be much used, partly perhaps because the patient feels nothing and is hardly satisfied; partly, I should judge also, because it has a vague general diffused effect, and I suppose it may be doubtful whether it is beneficial or harmful. By these closed-in currents nothing is taken in or out of the body, not even electrons, as by nearly all the other processes: they are

simply made to circulate round and round, and what this may do I do not know. Perhaps if long continued it might induce temporary paralysis of the nerves, but in that case it would be best to experiment on a limb rather than on the body, with a smaller spiral adapted to surround a limb. On the whole, it appears better to use the more definite local application of the B circuit or the recoil kick; and I am told this is not only destructive of lupus, but is helpful in rheumatic affections and in neuralgic and some abdominal pains.

What they mostly used at Vichy was a brush discharge or effluvium obtained from a large static machine, and once more I repeat that for many purposes a static machine may be the handiest instrument to use: it can give the effluvium, it can give Leyden jar B sparks, it can excite X-ray tubes, and with the effluvium there is always some ultra-violet light; it has a more gentle continuous power than the violent strength of a coil excited from the mains through a revolving mercury break, or even the more moderate Wehnelt break. But there is one difference to be noted, viz., that the brush or effluvium from a Wimshurst has "*sign*": it is in one direction, it is not alternating, there is nothing of high frequency about it. Accordingly, though weak, the patient feels it more; and when applied, say, for rheumatism or other joint affections, he feels a sting which assists his imagination and makes it more popular, and, as I was told at Vichy, fairly successful. The effluvium from such a machine is likewise applied to the head by a sort of pointed cap held above it on an insulated bracket, the patient being seated on an insulated stool, which stool is connected with the other terminal of the Wimshurst. Sparks can be drawn from any part of his body when he is thus insulated, as can indeed be done while under the influence of high frequency discharge even when he is uninsulated.

Radium.—But of all the simple and convenient methods of applying rays to the body, nothing can compare with radium. It is best to have the radium in little glass tubes, or otherwise enclosed, so that it shall not be affected by perspiration and the like, and so that the tube can be perfectly cleaned and disinfected.

Mr. Mackenzie Davidson's practice is to strap three or four such tubes, for 20 minutes at a time, on a rodent ulcer, and after a few applications, at intervals of a week, he says it always benefits.

Mr. Hall Edwards makes the same assertion for lupus when treated by the high frequency effluvium. In the latter case it may possibly be the ultra-violet light concomitant which is doing the work. In the radium case there is no ultra-violet light, but there is a mixture of cathode rays and X-rays, for the X-rays are stopped by the tube. The evidence seems to me clearly to point to beneficial influence on surface

diseases, but the deep-seated difficulty seems to remain as great as ever.

"Ionisation" is the property which seems to me most hopeful, but how it is to be applied and brought to bear in a discriminating manner, so as to affect unhealthy tissue in one way and healthy tissue in another, is a puzzle, unless the unhealthy tissue is on the surface so that it can be exposed while the healthy is mechanically screened. The only suggestion I have been able to make is a discrimination by injecting something into the one tissue which is not allowed to enter the other, and then applying the rays.

Radium rays have the best chance, inasmuch as they are the most penetrating rays known; moreover, the application is so easy and convenient, and the little tubes may be introduced into the tissues in some cases; or possibly radium in solution could be employed, for radium in solution is equally effective, since the effect is an atomic property and not dependent upon any particular chemical combination. The effect is strongest in the unstable gaseous temporary product of radio-activity called the "emanation," a product which would not be found in solution; it is, however, occluded in the dry powder, and to it three-fourths of the rays are due.

During the scarcity of radium, and perhaps even afterwards, the existence of substances with milder properties of the same kind is to be remembered; and hydroxide of thorium, for instance, which can be obtained for a few shillings an ounce, might be applied to a patient, in bags or otherwise, in such a way as to make up by long exposure for its deficient intensity. Radium can make an electroscope leak in a few seconds as much as thorium can make it leak in a few hours, but it is possible that if thorium were applied for a time reckoned in hours instead of seconds it might produce the same effect. At any rate, it is worth trial, and by reason of its feeble power it could hardly do harm, unless by mechanical irritation from unwise mode of application.

(*To be continued.*)

Remedial Effects of Air Medicated by Igazol and Formic Acid in Pulmonary Diseases.—It has recently been demonstrated that atmospheric air naturally contains a minute percentage of formaldehyde, and that this minute quantity has the power of augmenting muscular energy and the muscular resistance to fatigue. At the June meeting of the *Académie de Médecine* Dr. Clements demonstrated that formic acid and its compounds increase both muscular energy and endurance. Mr. R. Hall, of Belfast, has proved the marvellous efficacy of air medicated with Igazol in reducing the tendency to cough, night-sweats and high temperatures.

ON THE METHODS OF APPLICATION OF HIGH FREQUENCY CURRENTS.

By Clarence A. Wright, F.R.C.S. (Ed.), &c.

(Continued from p. 282.)

Fluid Electrodes.—These partake of the nature but differ from the ordinary type of condenser electrodes in the use of an electrolytic solution in place of a metallic conductor as the medium of electrical conduction. In the best models, an accessory bulb or chamber is provided to trap any air bubbles that may find their way into the interior of the tube. As points of structural interest, that deserve more than a passing mention, the nature of the insulating sheath and likewise that of the electrolyte employed demand our attention.

The Nature of the Insulating Sheath.—The substances, so employed, are chiefly solid bodies with a more or less limited capacity for heat-conduction: Hence it is that the heating effects of the discharges upon the electrode is more in evidence than when fluid insulators are used in conjunction with them. Attempts to minimize this inconvenience by the construction of double-chambered glass tubes for additional oil-insulation have hitherto proved unsatisfactory.

Although glass is in most constant requisition as a dielectric, it by no means enjoys a monopoly of use: We are even now in possession of nasal, urethral, rectal and vaginal electrodes formed of pure indiarubber, into which any quantity of the electrolyte considered requisite can be readily introduced after they are placed in position. For spinal applications, the ordinary spinal ice-bag slightly modified (*i.e.*, provided with a longer rubber feed and a metallic plug as terminal) answers admirably; whilst for unhealthy, ulcerating surfaces, conditioned by a possibility of infection, pegrimoid and waterproof paper bags are of great service.

The Nature of the Electrolytic Solution.—The tubes listed on most catalogues of electrical instruments are almost invariably filled with *fluid* solutions of various salts, acids and bases, and of various degrees of concentration. As no regard for the general principles of electro-chemistry or for those primarily concerned with electrical conductivity seems to determine either the nature of these solutions or their specific density, it may readily be conjectured that this haphazard system of selection of electrolytes is by no means the *ultima Thule* of advancement in this direction. The existence of *colloidal* solutions seems to be wholly unsuspected. These pseudo-solutions can with advantage replace fluid electrolytes, more especially as they exhibit very small osmotic pressures and corresponding small rates of diffusion, depression of freezing point, etc.

In an electrolytic solution, electrical conductivity is a function of the solvent as well as of the dissolved substance. The dissociative power of a solvent has a simple relation to the associative tendency of its molecules. To illustrate: hydroxylic liquids, as water and alcohol, exhibit a tendency to form complex molecules, whilst as solvents they are characterized by their dissociative powers, *i.e.*, they not only prevent the association of the molecules of the dissolved substance but even (in the case of salts) dissociate the normal molecules into their simpler constituents. Hydro-carbonacious solvents (as benzine), on the other hand, exhibit no tendency towards molecular complexity. They promote the association of the molecules of the dissolved substances or else do not exert any inhibitory influence upon them. These facts can be harmonized by the following general consideration. The molecules of self-associative fluids are characterized by their marked proclivity to intercombination. This property of the molecules may, therefore, reasonably be supposed to be so exerted as to oppose and overcome any self-associative tendencies that the molecules of substances dissolved in them may possess. On the other hand, the molecules of solvents, like benzine, which possess no tendency towards self-association, may be considered as without influence on the molecules of the dissolved substances, permitting them to retain in solution any self-associative properties that they may manifest in the undissolved state.

According to Nernst a relation, somewhat similar and equally harmonious, exists between the dissociative power of a liquid and its dielectric constant. The idea of the dielectric constant may be arrived from the following general consideration. If one pole of a battery of constant elements be earthed and the other connected with an insulated metallic plate so as to maintain it at a constant potential, and if at a definite distance from this plate be placed another, which being connected with earth is at potential zero; then the charges upon the plates will depend on the nature of the dielectric which separates them. The magnitude of the electrically opposite, equivalent charges give directly the dielectric constant, when that of air is assumed to be unity. The dielectric constant for water is 79·6 at 18° C., for ethyl alcohol 25·8, for ethyl ether 4·25, and for carbon bisulphide 2·6.

Again, the conduction of electricity through an electrolytic solution is effected by the movement of ponderable particles, each possessing a definite electrical charge. These particles—the active molecules of Arrhenius—are, for the most part, dissociation products of the dissolved substance. The undissociated particles are not only potentially inactive, but according to Hittorf they even impede the movement of the active molecules or ions. Hence it is that concentrated

solutions, which contain a considerable quantity of undissociated molecules, have a lower equivalent conductivity than when diluted so as to render dissociation complete. The close agreement between the predictions of the dissociation theory of Arrhenius and facts experimentally established clearly proves its superiority to that of Clausius, who assumed that conductivity depended on the frequency of changes between the parts of the molecules, and must therefore necessarily increase with increasing concentration, which is known to be contrary to fact.

Having thus laid the foundations for a correct understanding of the factors influencing electrical conductivity in electrolytes, we leave the reader to work out for himself in fuller detail the changes brought about by the use of different solvents and of different dissolved substances, and by differences in the degree of concentration and of proportionate mixture of two or more solvents. These, together with the variations due to changes of temperature in the electrolytic solution determine both the equivalent conductivity of the electrolyte and the character of the local reaction.

Vacuum Electrodes.—The simple laws of Boyle, Gay-Lussac and Avogadro, which connect in a perfectly definite manner the temperature, pressure, volume and number of molecules of all gaseous substances, irrespective of their chemical composition and other physical qualities, point to a great simplicity and likeness in the mechanical properties of gases. Among the various hypotheses that from time to time have been brought forward to explain the behaviour of gases, the only one that has been found to be at all satisfactory is that known as the *Kinetic Theory*, which has been fashioned to its present form by the labours of Clausius and Clerk-Maxwell. According to this theory, the particles of a gaseous body—which are assumed to be identical with its chemical molecules — are practically independent of one another and are moving rectilinearly and very briskly in all directions. Being conditioned as to space, collisions of more or less frequent occurrence take place between the individual molecules and between them and the walls of the container; but as both they and these walls behave as perfectly elastic bodies, these entail no loss of energy but an alteration in the direction and in the relative velocities of the particles. All phenomena of gases, according to the Kinetic Theory, depend on the particular nature of the action that takes place at these encounters and upon the frequency of their occurrence. Diffusion, viscosity and conductivity are, in gases, connected to each other in a simple way, being the rate of equalization of three properties of the medium, *i.e.*, the proportion of its ingredients, its velocity, and its temperature, equalization being effected by the agitation of the molecules. If, therefore, the

state of a gas be considered as conditioned by temperature and pressure, the coefficient of diffusion of a perfect gas into itself, its viscosity and equivalent conductivity will vary directly as the square of the absolute temperature and inversely as the pressure. But since all known gases are more or less imperfect, it follows, from a consideration of the Mechanical Theory of Heat, that if one of the factors determining the equilibrium of a system be varied, the state of equilibrium undergoes a change in that direction, which tends to counteract the original variation of the factor. If the preceeding propositions be properly understood, it is easy to comprehend the principles governing the behaviour of vacuum electrodes of various degrees of exhaustion.

Electrodes of relatively low vacuum are suitable for the ordinary purposes of treatment as they meet all the indications; but the desire of combining treatment by the X-rays with that by electrical discharges has so rapidly gained ground that there is now a steady demand for tubes with higher degrees of vacuum. It has been claimed by several observers that the vacuum of highly exhausted vacuum tubes increases with use; but if the oscillatory character of the currents be regarded, it must be admitted that the possibility of producing any such change by this means is very remote. As regards the central pin of these electrodes, it may be said that those terminating in an expanded, cupped, free extremity seem to promote a freer discharge of X-rays, but further experiment is needed to determine whether this is accidental or otherwise.

The Impluvium, Rose or Effluver.—This necessary adjuvant to treatment by the *effluve* essentially consists of a flat metallic disc, whose free surface is studded by a number of blunted pegs, placed concentrically or in parallel rows. Owing to the liability to sparking from the free edge of the disc and the difficulty of keeping the electrodes perfectly free from dust, etc., the metallic parts of the electrode have in some models been heavily insulated and the pegs not allowed to project beyond the level surface of the insulator. This insures an equal degree of efficiency with a higher regard for cleanliness and comfort. Among the many modified forms of this electrode that deserve mention are:—

(*a*) *The Epaulet Electrode of Weill,* employed in making applications to the shoulder or nape of neck;

(*b*) *The Crescent Electrode,* for chest or abdomen;

(*c*) *The Spider Electrode of Truchôt,* for administering a cephalic douche;

(*d*) *The Cup Electrode,* employed with Reus' cones or Guilleminot's spirals to effluvate the head or chest. In this case the discharge takes place from the free edge of the cup

as well as from the serrated free margin of the spiral rose which it encloses.

GRADUATION.—The three methods by which some degree of control can be exercised over the intensity of the discharge and the effects produced are :—

(1) By direct regulation of the apparatus employed ;

(2) By accessory measures subservient thereto ;

(3) By certain variations in the condition of application.

(1) *Direct Regulation of the Apparatus Employed.*—As the simple transformer of high frequency allows of no direct graduation of effect, one is compelled to resort to certain accessory measures to supply the deficiency ; the details of these procedures will be found in the second and third methods of graduation. On the other hand, where an apparatus of high tension is the immediate source of the currents, which actuate the e'ectrode, an easy and more extended regulation of effect can be observed.

A resonator of Oudin yields its maximum when the Capacity and Self-induction of the two solenoids, of which it is composed, are in accord, that is to say, satisfy the same conditional equation. Any variation of either of these two factors will produce an attenuation of effect. In practice graduation is effected either by varying the number of spirals included between the metallic leads coming from the external armatures of the condensers or by a readjustment of the connection between the movable contact-point and the upper spirals. The former method is to be preferred as it allows of a finer graduation of effect, provided always that one of the newer model resonators be used : For the older type of resonators, in which the crude spring-catch adjustment is still a marked characteristic, the latter method is more suitable, for although the variation of intensity is both abrupt and sudden, still it is not attended by the drawbacks which proceed from the removal of the spring-clip when readjustment by this means is attempted. In the duplex resonators, so much in demand for bipolar applications, the results are magnificent as long as currents of maximum intensity are employed ; but when a graduation of effect is essayed, it is found that adjustment is both difficult and unsatisfactory.

In the d'Arsonval coil of high tension, the position of the outer or inducing coil largely influences the intensity of the derived current, and its alteration affords some measure of control : When centrally placed, the current derived from the secondary terminals are of equal tension and density ; when placed at one extremity and the corresponding pole carried to earth, the current from the opposite pole gives a very beautiful effluve.

With Guilleminot's Spirals and Reus' Cones, graduation is effected by altering the distance between two cones or

spirals, as well as by varying the point of attachment of the wires leading to the armature of the condenser or by changing the direction of their winding.

(2) *Accessory Measures tending towards Graduation.*—The capacity of the condensers, the strength of the current employed to feed the transformer, and the adjustment of the discharging knobs of the spark-gap have each and all an influence upon the effect produced.

The capacity of the condensers affects both the frequency and amplitude of the current oscillations. In all apparatus in which plate condensers are employed, a graduation of effect can be obtained by varying the distance between the two plates. With Leyden jars of the ordinary type, a difference of capacity can only be produced by varying the number of condensers thrown in or out of action. With condensers of variable capacity, graduation is effected by alteration in the size of the surfaces that are dielectrically opposed to one another.

The strength of the current employed to feed the transformer can be varied: (*a*) by controlling (by means of a rheostat) the primary current that actions the coil; (*b*) by varying the self-induction of the primary circuit of the coil by connecting its layers in parallel or in series; (*c*) by altering the frequency of interruption in the primary circuit.

The adjustment of the spark-gap by altering the equilibrium of the condenser-circuit affects the frequency and amplitude of the oscillations of the discharge that passes between the knobs of the discharger. A somewhat similar graduation can be effected by altering the pressure of the air in the spark-gap.

(3) *Certain Variations in the Conditions of Application.*—Independent of the type of apparatus employed to generate the oscillatory currents or to increase their tension, and the kind of electrode used to make the applications, are certain conditions which have an important influence upon the reaction. It has been already mentioned that the continuous or interrupted character of the current discharges have some bearing on the effect: for the number and intensity of the radiations vary as the distance between the electrode and skin. As the distance increases, the number of radiations become numerically less but of greater intensity, as the difference of potential must be proportionately greater to overcome the increased resistance of the intervening air-space. The concentrative effect of the brush electrode enclosed in a cylindrical tube has also been referred to. A distinction has likewise been drawn between the effects of mono- and bipolar applications, the increased density of the poles influencing the results, both systemic and local. The reaction is also found to vary with the state of electrification of the body of the patient. The application of one or more fingers of the operator to the surface of the electrode is also an accessory

measure of graduation, but the most ingenious device for controlling the intensity of a current discharge is the CONTROL HANDLE. In that devised by Bisserie, the sliding of a metallic rod, by means of a thumb-rest, so as to approach or recede from a metallic ball in direct communication with the lead passing from the resonator into the interior of the electrode, provides an alternate circuit of discharge to earth, and so controls the intensity of the discharge. In a control handle made to my design by Messrs. Harry W. Cox, Ltd., a more regular graduation of effect is secured by a milled nut, whose movement directly controls the distance between the discharging knobs of the alternate circuit, and as this spark gap is enclosed in the interior of the handle, it occasions less alarm in the mind of nervous patients. The use of a flexible metallic wire in place of the chain of which Bisserie makes use, has also its advantages.

DURATION AND FREQUENCY OF SESSIONS.—These vary with the nature of the case, the extent of the lesion, and the reaction that it is considered requisite to produce. The duration of an application is limited when the area to be treated is small; but it is of longer duration when the lesions are numerous or widely distributed. The length of the sessions is restricted when purely cuticular diseases are being treated, but they must be prolonged when the discharge has to be brought to bear upon structures more deeply situated. The sessions are repeated when, in the opinion of the operator, the local reaction has sufficiently subdued to render such a procedure safe.

(*To be continued.*)

PHYSIOLOGIC AND CLINICAL ASPECTS OF HYDROTHERAPY, WITH ITS SPECIAL REFERENCE TO THE TREATMENT OF PSYCHOSIS.—R. D. Baker, after discussing the physiological action of hydrotherapy and the most important hydriatic procedures and their applications in infectious fevers, reports the results obtained in 23 cases of nervous diseases, including acute melancholia, acute melancholia with agitation, dementia præcox, hysteria, and puerperal insanity. The prominent mental symptoms were depression, slowness of thought, little interest in self or surroundings, painful delusions, confusion, hypochondriasis and insomnia. Nerve and muscle tone were impaired, circulation sluggish, second sound accentuated, appetite absent, skin muddy, intestinal fermentation and constipation. Ablutions at 95° F. with friction, reducing 5° daily until 65° was reached, was used in some cases, in others a wet pack at 65°, followed by a general fan douche at 60° and 25 pounds pressure for 20 seconds, friction and open-air exercises. In patients with flabby acne covered skins, the wet pack was continued two to three hours, the colon being irrigated just before with salt solution at 110°. In some cases the douche alone was used. The patients became brighter, more interested, and calmer.—*Medical News*, March 26th, 1904.

THE ACTION OF THE RAYS FROM RADIUM UPON SOME SIMPLE FORMS OF ANIMAL LIFE.

Journ. Physiol., Cambridge **30**, p. 449.

An interesting communication on the effects of radium on some of the lower organisms has been recently published by E. G. Wilcock.

This author has experimented with a number of chlorophyll containing organisms, and has found that these, and these only, are sensitive to the action of the rays. To the "β"-rays there was a definite negative radiotaxis. The method of experimentation was to expose the organisms in a cell through which a pencil of the "β"-rays could be directed. In the course of a few hours all the animals had moved out of their path.

Organisms which did not contain chlorophyll did not seem to exhibit this power, although they speedily disintegrated under the influence of the rays.

The experiments with the two common forms of hydra were especially interesting. Hydra viridis showed a great power of resistance to the rays when prevented from moving out of their sphere of influence, although whenever possible the animal would move out of the path of the rays as quickly as possible.

Hydra fusca, on the other hand, an animal which does not contain any chlorophyll, did not move out of the path of the rays, but was rapidly killed by them.

Experiments were conducted to ascertain which part of the animal was susceptible to the rays, and the animals were bisected, a procedure which is followed, in these animals, by no great interference with their normal course of existence. It was found that the oral disc was the part most susceptible, only this half of the animal moving out of the path of the rays.

The fact that chlorophyll is a substance of very marked fluorescent properties may have some bearing upon its protective and sensitizing powers.

This point is of special interest in that the chlorophyll in these animals is probably only contained in the cells of commensal algæ, and exhibits in a very marked way the mutual relationship existing between the alga and its host.

Other colourless organisms such as Opalina ranarum, etc., did not exhibit any sensitiveness to the rays.

The experiments so far were conducted with the "β"-rays, only a disc of lead being interposed between the organism and the radium. Exposure to the full effect of the naked radium was more marked, Hydra viridis even being affected and disintegrated, although in this case also the effect of chlorophyll was seen, the green variety being more resistant than the brown.

INTERNATIONAL ELECTRICAL CONGRESS OF ST. LOUIS.

12th to 17th September, 1904.

We are informed that under the auspices of the Louisiana Purchase Exposition, an International Electrical Congress will be held in St. Louis, during the week 12th to 17th September.

The Congress will be divided into two parts, namely,

(1) A Chamber of Government Delegates appointed by the various Governments of the world, invitations to which were issued at the beginning of the year from the United States Government. The transactions of the Chamber of Delegates will relate to matters affecting international questions of electrical units, standards, and the like.

(2) The Congress at large, divided into eight sections, as follow:

General Theory: *Section A.*—Mathematical,
Experimental.
Section B.—General Applications,
,, *C.*—Electrochemistry,
,, *D.*—Electric Power Transmission,
Applications: ,, *E.*—Electric Light and Distribution,
,, *F.*—Electric Transportation,
,, *G.*—Electric Communication,
,, *H.*—Electrotherapeutics.

Our readers will be interested in Section H—the Electrotherapeutic Section.

The President of the Committee of Organization is Professor Elihu Thomson of Lynn, Mass. The Vice-Presidents are B. J. Arnold, Prof. W. E. Goldsborough, Prof. H. S. Carhart, C. F. Scott, Dr. S. W. Stratton.

The Chairman of Section H is Dr. W. J. Morton, New York City, and the Secretary is Mr. W. J. Jenks, of New York City.

Three hundred and forty-three official invitations were issued some months ago to well-known workers in electricity, inviting papers for the Congress. One hundred and sixty-eight of these invitations were issued to persons residing in countries outside of North America. As a result of these invitations, one hundred and five American and fifty-nine foreign specially prepared papers are promised to the Congress. Of these, five foreign and fifteen American papers are in Section H, as follow:

Section H.—Electrotherapeutics.

Chairman, Dr. W. J. Morton ; Secretary, Mr. W. J. Jenks.

NAME OF AUTHOR.	TITLE OF PAPER.
Prof. M. Benedict,	"Radiology in the Pathology of the Brain."
Dr. J. Bergonie, M. le Docteur G. O'Farrill,	"Some Improvements in Generator Apparatus of High Frequency Currents."
Prof. S. Schatzky,	"The Ionic Theory as Biological Basis for the Therapeutic Action of Electricity."
" "	"Experimental Researches on the Treatment of Tuberculosis by Constant Current."
Dr. J. Rivière,	"Physico-Therapy of Neurasthenia."
Dr. Carl Beck,	"Recent Advances in Röntgen-Ray Science."
Dr. Russell H. Boggs,	"Diagnosis of Calculi by X-Rays."
Dr. G. G. Burdick,	"Radiations in Therapeutics."
Dr. Margaret A. Cleaves,	"The Nature of the Changes Established in Living Tissue by the Action of Oxidizable Metals at the Anode."
Dr. Charles R. Dickson,	"Some Observations upon the Treatment of Lupus Vulgaris by Phototherapy, Radiotherapy, and otherwise."
Dr. Emil H. Grubbe,	"X-Rays and Radio-Active Substances as Therapeutic Agents."
Dr. T. Proctor Hall,	"The Principles of Electrotherapeutics."
Dr. J. H. Kellogg,	"Electrotherapeutics."
Prof. Jacques Loeb,	"The Control of Life Phenomena by Electrolytes."
Dr. John Williams Langley,	"The Purification of Water for Drinking by Electricity."
Dr. G. Betton Massey,	"The Cataphoric Diffusion of Metallic Ions in the Destructive Sterilization of Cancer and Tuberculous Deposits."
Dr. W. J. Morton,	"Artificial Fluorescence of the Human Organism as a Means of Treating Disease."
Dr. C. S. Neiswanger,	"Static Electricity in Chronic Nephritis."
Dr. Clarence E. Skinner,	"A Large Fibro-Sarcoma Treated by X-Radiance."
Dr. Wm. Benham Snow,	"Static Electricity in Therapeutics."

Up to the 30th of June, 1,787 adhesions to the Congress had been received, of which about 1,300 have paid their subscriptions of $5·00 each. Of these 291 are from countries outside of North America. The following societies will co-operate with the Congress at St. Louis, by holding simultaneous conventions and joint sessions:

The American Institute of Electrical Engineers,
The American Electrochemical Society,
The American Physical Society,
The American Electrotherapeutic Association,
The Association of Municipal Electricians.

The following societies will co-operate with the Congress by appointing delegates:

The National Electric Light Association,
The Association of Edison Illuminating Companies.
The Société Internationale des Electriciens,
The Schweizerischer Electrotechnischer Verein.

It is expected that various other European societies will also co-operate.

Fourteen thousand six hundred invitations have been issued to persons interested in electricity all over the world, inviting them to join the Congress. It is expected that the Transactions of the Congress will attain two or three large volumes. Persons interested in electricity and who desire to join the Congress should apply to the General Secretary, Dr. A. E. Kennelly, Harvard University, Cambridge, Mass.

Each member of the Congress is entitled to receive one set of the Transactions. It is intended to issue the Transactions of the Congress, when printed, to libraries and non-members for $ 10.00 per set.

NOTES AND ABSTRACTS.

ELECTRO-CHEMISTRY.

The Electrolytic Process of Testing for Arsenic in Dilute Solutions.—The difficulty of obtaining zinc absolutely free from contamination with arsenic for use in the hydrogen generator of the Marsh-Berzelius apparatus, induced the Committee appointed by the Commissioners of the Inland Revenue to adopt Lord Kelvin's suggestion and devise an electrolytic cell, in which the hydrogen is generated by the passage of an electric current through an acidulated solution to which the suspected material has been added. In the case of beer, the addition of amyl alcohol is recommended to prevent frothing. The gas, liberated, is carefully dried before it is passed through the heated glass tube, where the arsenical mirror is formed.

In a recent contribution to the proceedings of the Manchester Literary and Philosophical Society, Mr. William Thompson, F.I.C., discusses the results obtained by the electrolytic process, and compares them with those obtained by the classic method of testing. He has noticed that when arsenic is present in smaller quantities than $\frac{1}{100}$ of a grain per gallon no mirror can be obtained with the electrolytic apparatus designed by the Committee. The use of other metals in the place of platinum as cathode have, with one exception, proved unsatisfactory. With a piece of granulated zinc attached to the platinum wire as cathode the results were better, but even then did not come up to the Marsh-Berzelius standard. When the cathode was a rod of pure zinc, the electrolytic process gave results in every way as delicate as those obtained by the classic method. As might naturally be supposed, the addition of amyl alcohol, by increasing the viscosity of the fluid, interfered with the delicacy of the test, whilst invert sugar made a less appreciable difference.

ELECTROTHERAPY.

Effects of Alternating Current Baths upon the Heart.—Speaking from an experience based upon a number of observations, Büdingen and Geissler recommend the use in cardiac affections of the alternating current baths, introduced by Smith and Homung. They have found as the results of such treatment a distinct improvement in subjective symptoms and a corresponding change in the physical condition of the patient. The dyspnœa, precordial oppression and palpitation yielded from the commencement of treatment. At a later period the œdema disappeared, the area of cardiac dulness diminished and the pulse rate fell, whilst the heart's action became more vigorous and regular. In recognising its remedial value, the authors recommend that it should not be used to the exclusion of other well-known therapeutical

measures. They attribute its beneficial action to the stimulating effect of the current upon the contractile elements in the circulatory and general muscular system, which produces an alteration in blood pressure and an increased lymph circulation. In the selection of cases for treatment, great care has to be taken to exclude cases in which the heart, owing to a deficiency of residual energy, needs rest rather than active stimulation. Extreme cardiac debility with dilatation and advanced arterio-sclerosis are recognised as contraindications. —*Münch. med. Wochens.*, May 3rd, 1904.

The Treatment of Rheumatismal Amyotrophy.—Partos considers that treatment should only be commenced after the febrile stage is passed and the local pain and swelling have almost disappeared. He recommends Electrotherapy and Mechanotherapy as most suitable at the commencement of treatment, whilst Balneotherapy is only resorted to at a later period, and always with great circumspection. The form of electrical treatment he favours is faradization with weak currents and small electrodes—brushes by preference—so as to promote a gentle excitation and hyperæmia, which, by acting in conjunction with the muscular contractions, favourably influences the nutrition of the underlying tissues. As treatment proceeds, he gradually increases both the strength of the current and the size of the electrodes, occasionally directing the current through the affected articulation. He meanwhile perseveres with gentle massage, to which passive and active movement and resistance exercises are cautiously added. After six or eight weeks of such treatment mud baths, both local and general, are resorted to, but the massage douche is reserved for cases in which the patient is sufficiently recovered to benefit by the considerable hyperæmia that this method of treatment produces.—*Pester med.-chir. Presse*, July 12th, 1903, and *Wiener med.-chir. Presse,* March 6th, 1904.

RADIOTHERAPY.

Treatment of Internal Cancer by the X-Rays.—At the meeting of the *Académie de Médecine*, held on June 14th, Doumer and Lemoine gave an interesting description of the technique which they had made use of in the treatment of 20 cases of tumour of the stomach. In three cases they succeeded in obtaining a cure that was both lasting and complete; whilst a fourth patient was making rapid strides towards recovery. In a fifth case (a female) the improvement from the commencement was rapid and the tumour had almost disappeared, when a relapse took place, which unfortunately was not radio-therapeutically treated. The remaining cases were treated with varying degrees of success. Among those who had derived most benefit from the treatment was a female, whose case was reported in April last year. She still

continued in excellent health and had suffered no relapse. So completely were her powers of digestion restored that she could, with impunity, eat food of all kinds and varieties. She is now in robust health and absolutely free from the troublous symptoms (vomiting, melæna, distention, icterus) which had previously rendered her life miserable. The tumour, which in her case was the size of a hen's egg, disappeared after seven exposures. In all the cases of cancer the diagnosis was based on a careful consideration of the symptoms—presence of tumour, emesis, gastric pain and hæmorrhage, dyspepsia, emaciation, etc. Success was usually heralded by the complete disappearance of the tumour along with the functional disturbances it occasioned, or else by an equally remarkable reduction in its bulk.

The Treatment of Hæmorrhoids and Allied Conditions by Oscillatory Currents of High Tension.—In the *Lancet* of July 2nd, 1904, Mr. F. J. Bokenham gives an interesting summary of the results he had obtained during the past two and a half years. The author inclines, in the treatment of these affections, to the use of high vacuum glass electrodes, which, when excited, give out an abundant supply of X-rays. With metal electrodes he employs a current of 450 to 500 m.a., with glass electrodes one of 100 to 150 m.a. The duration of each session seldom exceeds 15 minutes, five minutes being the average. The following is a summary of the results in tabular form :—

Nature of Complaint	No. of Cases	No. of Applications	Results: Cured	Greatly relieved	Improved	Failures	Remarks
A—Simple fissure ...	13	5 to 6	13	—	—	—	Prompt relief of anal spasm.
B—Acute capillary piles	25	4 to 11	14	9	—	2	
C—Recurrent cases of extero-internal piles without marked hypertrophic changes	31	9 to 18	6	20	5	—	Improvement was almost immediate, and the associated constipation was at the same time relieved.
D—Chronic cases with indurated folds but without marked venous congestion ...	12	7 to 15	—	6	6	-	
E—Large venous external and internal piles ...	16	12 to 30	—	—	7	9	2 post-operative cases, the others old-stand cases, complicated by chronic gastro-intestinal disorders.
F—Post-partum piles (partial prolapsus recti) ...	6	8 to 19	4	2	—		
G—Pruritus ani with moist eczema of the parts	15	4 to 7	15	—	—	—	

Successful Treatment by the X-Rays of Sarcoma of the Upper Jaw, recurring after two Surgical Operations.—At a meeting of the *Soc. méd. des Hôpit. de Paris*, held on June 10th, Dr. M. A. Béclère, of the Hospital St. Antoine, exhibited this case. The patient was a young man, aged 27 years, who had twice been operated upon by Dr. Gangolphe, of Lyons, for a very malignant form of sarcoma, arising from the malar bone and involving the floor of the orbital cavity. On the last occasion enucleation of the eyeballs and ablation of the recurrent neoplasm had to be performed. From the time of the first operation (November 20th, 1900) he was treated by cacodylate of soda (4 to 5 centigrammes) daily, to which on the second recurrence (December, 1902) 30 centigrammes of lactate of quinine were added. During the first month of treatment by the X-rays he was given an injection of quinine hydrochlorate half an hour before each exposure. While in Lyons the patient was treated by Dr. Schall with an osmo-regeneration tube (placed at 10 to 15 c.m. from the part), in connection with a 10-inch coil actioned by a primary current of 8 to 10 ampères at 50 volts. The exposures, which were daily, lasted for three to six minutes. On his transfer to Paris the case was treated by Béclère by an "osmo-regulation" tube de Villard, placed at 15 c.m. distance and regulated to give rays No. 6 (by radio-chromometer of Benoist) of 3 H. penetration. From the commencement of treatment a steady and well-sustained improvement was noticed, and a cure was effected, after 40 sessions, without causing any injury to the skin.—*Archives d'Electricité médic.*, July 10th, 1904.

X-Rays in the Treatment of Ringworm of the Scalp.—At the February meeting of the *Soc. franc. de Dermat. et de Syphilographie*, Sabouraud showed 10 cases selected at random from among those which he had successfully treated by the X-rays. The treatment in each case consisted of a single exposure of 40 minutes' duration. By the 20th day all the diseased hair had fallen out and all the follicles were completely denuded of the parasite. At the end of the eighth week the patches were covered by a strong growth of healthy hair.—*Bull. méd.*, February 13th, 1904.

RADIUMTHERAPY.

The Therapeutical Use of Radium in some Nervous Affections.—At a meeting of the *Académie de Médecine*, held on February 16th, Dr. A. Darier drew attention to the value of radium application in the treatment of some disordered conditions of the nervous system. In two patients, suffering from spasmodic neurosis, in which the attacks in the one case recurred daily and in the other three or four times a week, all convulsive movements ceased after the first application of the

radium tube to the temples. In a case of neurasthenic pseudo-ataxia and one of recent facial paralysis treated by the same method, a cure was effected by the following day. The activity of the radium used varied from 10 to 7,000 uranies: with feeble intensities the application had to be continued for three to five days before pain was relieved, and it occasionally recurred immediately after the cessation of treatment; with radium of greater activity (1,000 to 7,000 uranies) the duration of exposure could be shortened to two to six hours.—*Semaine méd.*, February 17th, and *Arch. d'Elect. méd.*, June 25th, 1904.

Treatment of Hypertrophic Pharyngitis and Laryngitis by Thorium Emanations.—In the *Lancet* of April 23rd, 1904, Dr. Gordon Sharp records the case of a man, aged 36 years, who had for years complained of "a weakness in his voice" and an hypertrophic condition of the mucous lining of the pharynx and larynx (pachydermia diffusa). He had previously been treated by cod-liver oil and a generous dietary, coupled with local applications of glacial acetic acid but had received no permanent benefit. Inhalations of the emanations from a neutral solution of thorium nitrate were commenced on January 24th, 1904, and continued for six weeks. At the end of this period it was found that the nodules on pharyngeal wall had quite disappeared, the lingual tonsil (previously hypertrophied) had diminished in size, as also the interary-tenoid swelling; so that the cords could be adducted in their entire length. The inhalations were made daily for one hour, and always at the same time, from an all-glass inhaler fitted with special glass caps, capable of holding 500 c.cm. of water. This was partly filled with water in which 100 grammes of neutral thorium nitrate were dissolved by agitation.

PHOTOTHERAPY.

The Biological Effects of Blue Light upon Muscular Energy.—In the *Annali di electric. med. e di terapea fisica*, An II, No. 8, Pisani gives us the results of some experiments made by him to determine the effects of the blue radiations upon muscular energy. He prefaces his remarks on their effects by a rapid review of the more recent advances in photo-therapy and known principles of photobiology. By making use of the ergograph of Mosso in his experiments, he succeeded in obtaining a very remarkable series of tracings, which seems to point to the fact that more work can be accomplished under the influence of blue radiations than by ordinary light. This is proved by the number of the contractions, their amplitude and the kilogrammes raised. He has noticed that the duration of the exposure has a marked influence upon these effects, for if the light be allowed to act

upon the muscles for more than half an hour the ergographic tracings give evidence of a transient but noticeable increase of energy, followed by a depression as well defined. The beneficial effects of the blue radiations upon muscular work is even more clearly established by comparing the ergographic records of the work done under ordinary conditions with that accomplished under the influence of blue light. In the latter case, evidence of augmented activity and increased resistance to fatigue can be noticed. In tracing, made during alternating periods of exposure and of darkness, the elevations of the ergographic curve are found to coincide with the former, its depressions with the latter. Having experimentally proved that neither ordinary white nor red light exert a similar influence, the author concludes by insisting on the fact that in the blue radiations we have one of the most active means of sustaining muscular activity.—*Arch. d'Elect. méd.*, May 25th, 1904.

Phototherapy in the Treatment of Inflammatory Affections of the Uterus and its Appendages.—According to Orloff, phototherapy can with advantage be employed in a great number of inflammatory affections of the uterus and its appendages. Besides the well-known analgesic effects of the electric arc, we have also to remember its very beneficial influence upon exudates, which become rapidly absorbed. Phototherapy can therefore with advantage be used in erosions of the neck of the uterus and in spasmodic dysmenorrhœa. Pregnancy, menstruation and uterine hæmorrhage are to be recognised as contraindications to treatment.—*Rousskii Vratch*, No. 38 for 1903, and in *Arch. d'Elect. méd.*, May 25th, 1904.

THERMOTHERAPY.

The Electrical Hot-Pack.—Rutkowski, in the *Rousskii Vratch*, No. 42 for 1903, describes the method he employs in treating cases by the electrical hot-pack. The body of the patient, with the exception of one hand and the head, is wrapped in a damp linen sheet, as in the ordinary general compress. By means of an electrode, usually the cathode, which is placed in contact with enveloping sheet near the patient's feet, and a manette held in the free hand, the circuit is completed. Galvano-faradization, with a continuous current of two to five m.a., and a faradic current sufficiently strong to be appreciable to the free hand is the form of electricity applied to the patient. Rutkowski claims that this thermo-electric treatment exerts a very favourable influence upon the nutrition of the peripheral neurones, and stimulates leucocytosis and the cutaneous circulation.—*Arch. d'Elect. méd.*, May 25th, 1904.

ERGOTHERAPY.

A Psychological Theory of Treatment of the Insane by Work.—In the March-April number of the *Nouv. Icon. de la Saltpetrière* Bianchini insists upon the benefits in most types of insanity of suitably chosen forms of manual labour, and gives the statistics of the patients so treated in his own institution. In the insane, consciousness is distorted, but not abolished: useful work with a definite aim is no longer spontaneously done, but can be attained by means of re-education and mental suggestion, and this activity has, if not a curative, at least a preservative influence on the intelligence. —*Review of Neurology and Psychiatry*, vol. ii, No. 7, for July, 1904.

Treatment of Varix by Walking Exercises.—At the June meeting of the *Académie de Médecine*, M. Marchais read a paper in which he insisted that varix could, if recent, be cured, and the general symptoms relieved by any means that would directly accelerate the flow of blood through the parts. He recommended massage to correct œdema and muscular atrophy, and walking exercises to promote the flow of blood in the veins of the lower extremity. He instanced 22 cases that had benefited by this treatment in support of his views.—C.R.

AEROTHERAPY.

Medicated Air.—In an interesting and very suggestive article that appears in the July number of *The Nineteenth Century*, Dr. William Ewart makes an earnest appeal for greater attention to atmospheric hygiene, and some good suggestions as to the lines upon which its development should proceed. He recognises as facts: that the medicine bottle is no longer the fetish of popular credulity, that faith has in some measure been diverted to Open Air as a curative formula, and that the elementary forces in the air of climates, which make for cure, exist in part in ours, but that Nature has made them subordinate to other and less favourable influences that Science may suppress. He points out that an ample measure of success has already been achieved in assimilating the air of our climate to those of others which are known to be beneficial to particular diseases, if not quite to the special requirements of the varying condition of different complaints. While the main constituents and qualities of the air have long been known, it is only now that its finer constituents and qualities are gaining recognition. The temperature, the moisture and the pressure of the atmosphere have already been submitted to control, and it is even now possible to provide within a limited cubic space a succession of artificial atmospheres differing in their value for purposes of treatment. The use of compressed and rarified air are known

to us, and establishments exist for the inhalation of steam and medicinal vapours; oxygen and ozone have likewise been summoned to the aid of the sick. But these have been casual expedients of the nature of "sittings" rather than means for their continuous application. Although the advantages of climate as a protection or as a cure must remain the exclusive privilege of the moneyed classes, some equivalent at least should be provided for the masses, upon whom the diseases even more heavily press. Above all, it must be remembered that the suitability of climate is an individual question, and facilities should exist for modifying the local atmosphere to meet individual indications. The recent observations made in Switzerland show that the air at moderate altitudes is several times more radio-active than in valleys, and favour the hope that a future elucidation of the mysteries of climate may result from a study of the physical agents already known to us, and of others yet to be discovered. He therefore insists that we should endeavour to learn how to treat air, so as to faithfully reproduce the virtues of various climates, and also to create an atmosphere to suit individual requirements (just as we regulate the dose of medicine or electricity) by varying the supply of the normal constituents and qualities of air and by adding other beneficial agents. He claims that medicine has hitherto gleaned rather than reaped in the fields of science, and here and there caught a casual seed which was to fructify under its own care. There is an illimitable harvest, and a new organization is needed, in which pure science should be given the place which it alone can fill. The difficult task of producing special atmospheres for the prevention and relief of some of our climatic diseases, for which special climates are distinctly beneficial, is distinctly beyond the unaided powers of medical art. It could not be successfully attempted without a systemic collaboration between the representatives of pure science, practical engineering and those of medicine. Labour and delay are inseparable from the attainment of practical results in the treatment of disease, and still more in connection with atmospheric hygiene as relating to the ventilation of houses and towns. This true necessity strengthens the claim for prompt action. For solid clinical results, however, we may not have long to wait, as a hospital, duly equipped, would from the first be fulfilling an urgent work of relief, on these less complicated lines which have already been found successful, and any other simple lines to come. To generous supporters of the scheme this would be an immediate reward. It would encourage and sustain those engaged in the weary work of research and provide the first fruits of that matured and systemic co-operation between medicine and science for which his article is an earnest and very touching appeal.

DIGEST OF AMERICAN LITERATURE.

CLIMATE.—*Personal Observations on the Advantages of Certain Arctic Localities in the Treatment of Tuberculosis.*—Dr. Frederick Sohon, who accompanied two of the Peary expedition to the Arctic regions, gives the following reasons for believing the Arctic regions to be favourable climatically in tuberculosis: *Constant sunshine*, which brings health and energy, a germless and dustless air that gives neither irritation nor extra infection; an unvarying and bracing temperature that invites out-door life and exercise; a climate that creates an appetite and a life that brings the ability to digest and assimilate; a life of new recreations that banish loneliness, and of enticing interests so different from the ordinary that absolute nerve rest is secured; a country in which colds and catarrhal conditions are not found, and even the healthy invariably improve in well-being. All of these advantages can be obtained elsewhere except the *perpetual sunshine* and the *germless air*, but in the Arctic regions they are furnished altogether and each in perfection. They are also furnished at a time of year when conditions are most unfavourable elsewhere. Three months under such conditions may be time enough for a cure in patients not greatly run down.—*American Medicine*, April 23rd, 1904.

(It is interesting to note in this connection that Dr. Sohon will conduct a party of tubercular patients in a sanitation ship to the fjords of Greenland this summer (the *Sun*, May 5th, 1904). Dr. Sohon, who has accompanied two of the Peary expeditions, had the opportunity of observing (1) the phenomenally rapid cure of one of the party who was consumptive; and (2) the climatic conditions, as set forth in the abstract of his article. While in the Arctics he made a careful study of the hygienic conditions of the northern latitudes, with the possibility of utilizing these regions in the treatment of tuberculosis and nerve exhaustion. The proposed tour of this colony of invalids is the result, and he believes that their Greenland summer is entirely feasible, both from a practical and medical standpoint. The *Sun*, in commenting upon this expedition, says that if it prove successful it may lead to the permanent utilization of a worthless territory, besides being the means of restoring many consumptives to health in the future. It is also of interest to note that the *perpetual sunshine* is considered a potent factor in the climatic conditions.—AM. ED.)

* * *

RAYNAUD'S DISEASE AND PHYSICAL AGENTS.—David G. Peyton reports a case of Raynaud's disease which, after three attacks involving both hands and feet, extending over a period of four and a half years. In the first attack he lost the entire cuticle of both hands and feet, which was shed *en masse*, and left the joints of both hands stiff. The second attack he recovered from in three or four weeks, but lost not only the skin of both hands and feet but the finger nails of both hands as well. The third attack came on February 15th,

1903. The previous day he had been gathering corn and was exposed to the cold. Peyton saw him first March 9th, 1903, and upon examination found all the fingers and thumbs of both hands thoroughly gangrenous, with perfect lines of demarcation formed just below the metacarpo-phalangeal articulation in the fingers, while in the thumbs, the line was near the middle. In both hands the evidence of nutritional disturbance was most marked, the soft parts breaking down under the least effort. Amputation was decided upon and completed without the use of Esmarch's bandage or anything to control the hæmorrhage, all the fingers of one hand being removed before the flaps were closed. In neither hand was there any hæmorrhage. Patient's temperature after operation ranged from 99° to 101° F. Union of the stumps of the right hand was by first intention. The left hand refused persistently to heal, and at the time the case was reported (June, 1903) had not fully healed. For the three weeks following the operation there was a tendency to a return of the asphyxiated conditions of both hands, and the line would form on both just above the wrist.

Treatment was entirely by physical agents, the writer stating that he did not believe internal medication of any value in this condition. The hands and arms were frequently douched with hot normal saline solution and alternate hot and cold douches along the entire course of the spine. Later, static electricity was used, both conductively, *i.e.*, with grounded area or wave current, and disruptively. On December 28th, 1903, the patient had entirely recovered, having been well for five months.—*American Medicine*, March 26th, 1904.

* * *

Sea Bathing in Some Forms of Skin Diseases.—Abrahams' experience with sea bathing in skin diseases extends over 10 summers, suggests the desirability of recommending this as a reliable curative agent in pityriasis versicolor, herpes, tonsurans maculosus et squamosus, chronic eczema, and pruritus senilis. He concludes from the fact that salt water, when used in bathing establishments, does not cure, that besides the chemic properties of the water, benefit is derived from the longer immersion, the pounding of the billows, thus rubbing the water more thoroughly into the skin, and also from the exposure to the sun in the intervals of the dips which drives the solids of the water into the skin; and, lastly, from the rolling on the sand of beach, which wonderfully helps to remove scales and other pathologic débris, thus affording the water a better chance to penetrate.—*Medical News*, March 26th, 1904.

(To the writer's mind one very potent influence is lost sight of by Abrahams in accounting for the results obtained, and that is the chemical frequencies of light, which are rendered much more active by the removal of scales and débris and the softened epidermis as a result of the sea bath. The skin is much more vulnerable, and the penetration is assured. That good comes from the other factors in sea bathing is without question, but the greatest good is due to the action of light.—Am. Ed.)

MEDICAL

Electrology and Radiology.

No. 9. SEPTEMBER, 1904. VOL. V.

EDITORIAL.

In July the Imperial Cancer Research Fund presented its second annual report. To all engaged in Radio-therapeutics everything connected with this disease is of prime importance, and it is exceedingly gratifying to note the interest taken in this work by the Prince of Wales. Not only has he allowed his name to be associated with the work of the Fund, but by his presence as chairman he has personally identified himself with this collective investigation.

The existence of this fund is in itself a hopeful sign, and we trust that it is one step by means of which the British public may be taught that purely scientific investigation has a real practical side. It would be difficult for the proverbial man in the street to see any possible utility in the study of electrical discharges in vacuum tubes, and he would have dubbed such investigation a harmless type of amusement for a scientist who liked to see pretty colours. And yet from such abstract work has the whole of modern X-ray diagnosis and treatment sprung. Still less would he have expected that the researches of Pasteur upon the optical properties of tartaric acid would have led to modern antiseptic surgery under the guiding hand of Lister.

One can only hope the Imperial Cancer Research Fund will prove as signally successful. We may have to wait long for the hoped-for "cancer cure," but it is assuredly on these lines that research must be carried out if this goal is to be reached, and we feel that the establishment of the fund marks an epoch not only in the history of the pathology of malignant disease, but in the history of scientific progress in England.

It is reassuring to find that the statistics which have been so far collected give no support to the popular idea that there is a great increase of cancer in England. With the more accurate diagnosis and greater thoroughness of macroscopical

and microscopical examination of tumours, both after removal and post-mortem, there must be of necessity an increase in the number of deaths ascribed to malignant disease.

Small support, too, seems to be accorded to the parasitic theory of the causation of cancer—a theory which it is difficult to reconcile with the clinical features of this disease.

Radium has been studied as to its effect on artificially transplanted tumours, the growth of which it seems definitely to retard, provided the tumour be superficial.

Unfortunately, it is just these superficial growths which are specially amenable to surgical interference, and it is much to be desired that a way could be found to bring deeper tumours into the sphere of practical radiotherapy. Still, there is some evidence that even subcutaneous malignant masses are affected by X-rays and radium.

We have had under our notice more than one case in which malignant glands following cancer of the breast have seemed to be definitely affected, and even to have been caused to disappear.

Against the failure of radiotherapy in cases of deep-seated growth must be set the fact that the treatment is yet in its experimental stage, and that the cases sent for treatment are those for which the surgeon can offer no relief. At present this is inevitable in common fairness to our patients, but in consideration of results it should be distinctly borne in mind.

We can only urge upon the workers in the field of radiotherapy the part they have to play in the solution of the problem of the treatment of cancer. Specially would we urge the microscopical examination, as far as possible, of portions of tumours before treatment, a piece of tumour as large as possible being removed in order that the nature of the growth may be ascertained the more surely. The more general use, too, of some method by means of which the therapeutic work of the tube may be estimated, such as the radiochromometer, would do much to reconcile present discrepancies as to length of exposure and condition of tube. In short, although radiotherapy is at present a rather empirical method of treatment, to endeavour by establishing the details of its application upon a firm scientific basis to enlarge the borders of its applicability.

At the Grenoble Congress in August a new Radiochromometer, devised by Sabouraud and Noiré, was described, and shown.

Its action is based in the fact, discovered by Villard, that the tint of the barium platino-cyanide screen changes to a yellowish brown when exposed for a considerable time to the action of the X-rays. This brown tint disappears on exposure to ordinary light.

In order to calibrate the instrument, a small disc, coated with the salt, is placed upon the skin, and the maximum exposure given, which will not set up dermatitis. The colour, which the screen assumes under these circumstances, is accurately imitated, and thus a permanent standard obtained.

The actual apparatus consists of a small pocket book, containing the colour standard and twenty-four detachable discs, coated with barium platino-cyanide. In applying it, one of the discs is placed in the direct path of the rays at a distance of eight centimètres from the anode, while the part to be treated is fifteen centimètres from the anode.

Treatment is continued until the colour of the disc corresponds to the standard colour. When this point is reached, the maximal dose possible without producing dermatitis is said to have been given.

We hope to give later details of the use of this instrument, comparing it with the radiochromometers of Benoist and Holzknecht.

The instrument certainly has the advantages of being easier of application and of being much less costly than the older forms, and we should be glad to receive any details of its use from any who have employed it.

LECTURES TO MEDICAL PRACTITIONERS ON PHYSICS APPLIED TO MEDICINE.

By Sir Oliver Lodge.

SUMMARY OF LECTURES V. AND VI.

HIGH FREQUENCY OSCILLATIONS.

(Continued from p. 321.)

Psychology and Therapeutics.—A course of lectures could be given, though not by me, on Psychology as applied to Medicine, or on the influence of the mind on the body generally. The facts of this character have been neglected or received with an unnecessary amount of doubt in this country; their investigation has been mainly conducted on the Continent, especially perhaps in France and Italy. I should like therefore to take this opportunity of calling attention to the work of Pierre Janet, Luys, Bernheim, Liébault, and others, as well as to the pioneering work of Elliotson, Esdaile, and Braid. There is a readily-understood tendency to receive anything new with suspicion and ridicule. Lord Lister has said that he had to run the gauntlet of ridicule when he advocated his antiseptic surgery in early days at Edinburgh.

Probably the chief men in a profession are too busy to be able to attend to or investigate assertions of new facts; but those who are going to be the leaders of the next generation are still young and are not too busy. These should keep an open mind in the direction of new discoveries, and not be deterred from examining into the evidence for them by merely conservative instincts. They will find a large amount of doubtful or erroneous assertion, and it is necessary to cultivate an instinct for distinguishing the valuable from the refuse. But so long as the main body of a profession hold aloof, new things are liable to be left in the hands of outsiders and half-educated persons, who, having caught a glimpse of truth, are liable to be intoxicated by it and attach to it an unbalanced importance, not realising its real place in the total scheme. It is the folly of uneducated advocates which destroys the early chances of so many new things. Nevertheless, inasmuch as there may be a grain of truth at the bottom of their assertions, which grain sometimes becomes the germ of a large and fruitful subject, it is not wise to ignore them indiscriminately, but to put all reasonably-urged and frequently-repeated statements to the test of experimental examination, unrepressed by *a priori* conviction; otherwise there grows up an air of un-

orthodoxy which deters younger men from risking unpopularity by an examination into unrecognised facts; and then advance in these regions is retarded, because the work gets into unsuitable hands, and the whole subject is left in a state of disrepute, unless it is taken hold of and worked up by foreigners—a condition of things which militates against this country taking a lead in such difficult investigations as have, or may have, an immediate bearing upon practice.

The influence of "suggestion," the operation of the unconscious mind on the body, is now beginning to be recognised even in this country, and indeed in its very simplest form has no doubt entered into practice, whether consciously or unconsciously, for a long time. The field of action of the unconscious mind is much larger than is generally supposed; and, moreover, there is really something more than the influence due to mere suggestion. There can be a communicated or telepathic influence, in addition to what is ordinarily meant by the word suggestion—not only the influence of the mind on the body, not only the influence of the unconscious mind on the conscious mind, but likewise the influence of one mind upon another. And if the recent assertions about N-rays, which are now beginning to be widely made in France, have any truth in them; if it be true that rays emanate, not only from muscles in a state of activity, but also from brain cells during a process of thought—then it is just possible that a solid physical basis may be found for our present somewhat vague conception of the telepathic process. So long as no physical experiments could be made, and so long as no rays could be detected by instruments, the supposition that they were brain-waves emanating from one organism and falling upon another, was not a theory worthy of attention, or even a legitimate working hypothesis; it was a mere guess, a hypothesis in the dark. But if it can be shown that there are rays actually emitted by brains in a state of activity, rays which can exert a visible influence on fluorescent screens—an assertion which by many is now made, and by some denied, and on which I express no opinion, being myself at present among the sceptical—then the supposition that these rays are the material or physical basis of telepathy becomes a real working hypothesis, and will be justified in receiving a large share of attention.

Nomenclature.—The terms atom, molecule, ion, electron, should be used with discrimination.

By an "atom" is meant the smallest part of a substance which cannot be divided without destroying the substance.

By a "molecule" is meant a group of atoms such as usually go about together, forming either a simple compound or a molecular aggregate in that compound. Thus, for instance, there are reasons for supposing that an ordinary

existing water molecule is a very complex aggregate—a comparatively large and massive thing. So also a molecule of protoplasm is a still more complex aggregate.

The new term, "electron," signifies the unit or atom of electricity, the negative electron being the only one at present known. It is the eight-hundredth part by weight of a hydrogen atom, and the thousand-billionth part of it in bulk. It is extremely energetic and rapid in its movements, easily travelling with something approaching the speed of light, and consisting of a considerable charge in proportion to its mass. To it all electrical phenomena are due.

The term "ion" (or "traveller") is Faraday's name for an atom associated with an electron—either one too many or one too few. If it has one too many it is negatively charged; if it has one too few it is positively charged. In either case it is called a monad. If it has two too many or too few it is called a dyad. All chemical phenomena are due to ions.

Ions are amenable to electrical influence, while neutral atoms are not. The electrical propulsion of atoms is due to their being harnessed to an electron. They may be likened to a massive inert waggon harnessed to a flea as strong as a pony, and thereby slowly drawn along. But if the traces are cut, the waggon is stranded, while the released propeller jumps forward with prodigious velocity.

"Ionisation" consists in knocking molecules into ions, which, being of two opposite signs, can re-combine before long.

The phenomenon at the cathode in a vacuum tube consists in unharnessing electrons so that they fly with great speed in straight lines against a target.

Radium atoms have the power of throwing off electrons spontaneously, thereby leaving themselves positively charged and self-repellent, which causes them to disintegrate or break into parts, which parts turn out to be the atoms of other substances.

ON THE METHODS OF APPLICATION OF HIGH FREQUENCY CURRENTS.

By Clarence A. Wright, F.R.C.S. (Ed.), &c.

(Continued from p. 328.)

Part III.—Treatment by Condensation.

In the absence of other conducting bodies from its vicinity, the charge, that can be communicated to an insulated conductor by a static machine or any other source of electricity of high tension, will continue to increase until all difference of potential between them is annulled. When this takes place the current ceases to flow; for the mutual repulsion of the affluent and residual charges, now of like sign and potential, prevents any further accumulation taking place. The conductor is then said to be charged, the quantity of electricity imparted to it being proportionate to its form and size. But in the case where other conductors are not excluded but placed in inductive relation with the capacity connected with the static machine, it may be noticed that the charge that can be communicated to it can be still further increased, the quantity varying as the number and size of the surrounding conductors and their proximity or distance from it. It is this principle that has been so advantageously applied to the construction of condensers.

In every form of condenser the three parts to be distinguished are the two armatures and the dielectric which separates them. The armatures are bodies of good—*but not necessarily of like*—conductivity: the dielectric, on the other hand, is essentially an insulating substance, chosen not merely on account of its non-conducting qualities, but rather for its more valuable *specific inductional capacity* or power of transmitting unimpaired electric undulations from a charged conductor to a neutral capacity placed on the opposite side. This property of inductive transference of energy must not be confounded with the resistive propendency of non-conductors. The two are not identical, nor can any direct relation be established between them. For it not infrequently happens that a substance that is a good insulator has a smaller dielectric constant than one much lower down in the same scale. A point of equal importance as the nature of the dielectric is the thickness of the layer separating the two armatures—for the thinner the layer the better the inductive effect.

It is evident, from what has been already said, that one armature of a condenser *must always be an active capacity;* the other may also be similarly charged, or it may, on the

other hand, receive an equal charge (but of opposite sign) by induction alone. There are, therefore, two cases to be considered: First, where *both* armatures are *actively influenced* by charges of opposite sign derived from a source of high potential; secondly, where only *one* armature is *actively* charged by connection with a source of electricity of high tension, whilst the *other* is a *passive* capacity that receives its entire charge by influence alone. Each of these cases has given rise to a distinct method of high frequency treatment which well exemplifies it.

In treatment by condensation the body of the patient is so placed that it constitutes one armature of a condenser, the other being a metallic sheet, which is dielectrically separated from it by some insulating substance of high inductional capacity and of suitable thickness. Of the three methods, by which this mode of vibratory electrisation can be carried out, two are remarkable for their general systemic reaction, whilst the third has a more restricted but very characteristic local effect.

GENERAL CONDENSATION.—As already said there are two methods employed for their general effects upon the system. In the first of these, the body of the patient is an *active* capacity, which derives a large percentage of its charge by its connection with one pole of the solenoid of high frequency; in the second method, it is a *passive* capacity, which receives its entire charge by influence. As in both cases the couch condenser is the apparatus employed to produce these effects, its description may well therefore precede that of the methods themselves.

The Couch Condenser.—It has been given various forms by different makers. In some it is a massive, cumbersome article of furniture better suited to the spacious receiving rooms of a general hospital than the private offices of the consultant and general practitioner; in others its dimensions have been so whittled down as to render its use more awkward than effective. For consulting rooms, where the amount of floor space is limited, the folding couch designed by the author meets all the requirements of the case. When extended it forms a couch of full size, and when not in use folds away very compactly. With more available floor space, the bentwood couch will be found useful. It is both strong and elegant, and does away with the multitude of unseemly expedients necessary to render the ordinary chair condenser effective. It, moreover, allows the patient to rest in an easy reclining position, the advantages of which are too well known to the experienced operator. With the exception of the seat it does not differ in construction from those usually met with in furniture stores. The seat is a sheet of metal carefully fitted into the body of the couch, and preferably

coated on *both* sides with a layer of some insulating material. Toward the head of the couch it protrudes somewhat to allow of the attachment of the binding-screws that connect it with the apparatus of high frequency. It is usually made of tin copper, aluminium or zinc, and constitutes *the armature of the couch condenser that is always active.* The substances employed as a dielectric are various. Some makers use cushions padded with horsehair or rubber strips to cover the metallic sheet; but their use can scarcely be recommended. Their dielectric capacity is extremely limited, both on account of the nature of the substance of which it is made, its inequalities in bulk, and the thickness of the layer required to secure perfect insulation with a current of high intensity. A composite material (formed of powdered mica, glass, shellac, resin, wood-fibre, metallic oxides and well-pulped paper) spread between layers of coarse canvas and rolled into sheets is to be preferred. In appearance it much resembles papier-maché, but is more durable and easy to handle, not so liable to crack and takes a good polish. Another material equally useful is coarse woollen felt impregnated with resin and shellac and then compressed. Gutta-percha, micanite, india-rubber and ebonite have been similarly employed. All of these are good dielectrics, not easily pierced by sparks, whilst the thinness of the coat required to insure perfect insulation much intensifies the inductive effects.

Bipolar Condensation.—In this method of treatment the body of the patient and the metallic sheets are both *active* capacities and connected with opposite poles of the cage of auto-conduction, the solenoid of high frequency, or even directly the external armatures of the Leyden jars themselves. In the first two cases, the intensity of the current passing into the body of the patient can be readily controlled; whilst in the last, the patient receives a charge of maximum intensity. Some form of contactual electrode is needed to connect the patient with the apparatus of high frequency; this is either a metallic disc applied to some part of the body, or more usually the manette, that may be permanently fixed to one arm of the couch condenser.

Unipolar or Simple Inductive Condensation.—This method of *unipolar* condensation must be carefully distinguished from that already described, as well as from *monopolar derivation,* with which it is more easily confounded. The most important point to be remembered is *that the patient, when on the couch, is free from contact with any active electrode.* His body is a purely passive capacity which receives its entire charge solely by induction or influence: the metallic sheet of the couch condenser is the only armature that is connected with the apparatus of high frequency, and received from it an *active* charge.

There can be no question whether the body of the patient treated by the bipolar method of condensation is in reality the seat of stationary oscillations. Its direct connection with a source of high frequency and the well-known facility with which these currents circulate in open circuit preclude all possibility of doubt. The quantity of electrical energy circulating in the system may, moreover, be directly measured by a d'Arsonval-Gaiffe milliammeter. On the other hand, it is a more difficult task to gauge the quantity induced in the body of a patient treated by the second method or even to establish its presence. It may, however, be experimentally demonstrated in the following ways :—

(*a*) When a neutral capacity—say a metallic rod or the finger of the operator—is brought in relation with the body of the patient a shower of fine sparks is seen to pass between them. These are not always painless, more especially when the intensity of the current circulating in the system is great. Again, when such a capacity—say the hand of the operator—is approached to the head of a patient but not placed sufficiently near to elicit sparks, the patient complains of a sensation of oppression and headache like to that caused by the movement of a small vessel in a choppy sea.

(*b*) A Tesla tube held in the hand of the patient or placed in contact with any part of his body is at once rendered luminous.

(*c*) If an electric lamp (100 volts) be intercalated in a wire circuit connecting the patient with an insulated conductor, the lamp at once becomes brilliantly illuminated. Even when the conductor is removed and the lamp is left attached by a single terminal, it continues to give a feeble light, which can be greatly increased by the operator laying hold of the globe, or by coating the globe with a layer of tin-foil, which is then earthed. This is due to the inductive effect of the hand, or tin-foil in contact with the glass-dielectric, upon the enclosed filament.

(*d*) If the metallic sheets (armatures) of two couch condensers be connected with opposite poles of the solenoid of high frequency and a chain of electric lamps be connected in series with the manettes held by the patients upon these couches, they become brilliantly illuminated. For the patients receive by simple inductive condensation a charge of opposite sign and reciprocal potential, which causes the wire connecting them to become the seat of electric oscillation of high frequency.

(*e*) If a milliammeter be substituted for the chain of lamps the strength of the current thus induced can be exactly measured. Repeated experiments prove that according to the dimensions of the couch this varies between 300 and 600 m.a.

Reaction.—With the exception of the tremor in the hand or parts with which the active electrode is connected, a healthy subject seldom manifests any sensible reaction. Unless the current be very powerful, the local sensation provoked by this method of electrification can be disregarded, as it gives rise to no bodily discomfort or pain. It is perhaps superfluous to add that tremor is entirely absent in treatment by simple inductive condensation.

Quite apart from these vibratile contractions is the well-marked train of symptoms, to which Apostoli first drew attention, and which he described as the *reaction of intolerance.* In its simplest and least marked form, it does not pass beyond a feeling of lassitude and weariness, which comes on during a session and lasts for some hours after its termination. Where the susceptibility of the patient is more marked, a sense of mental confusion is coupled with the more physical discomforts of nausea and epigastric oppression. In types still further advanced, malaise, headache, vertigo, palor and coldness of the skin and extremities, and lastly, profound exhaustion and prostration are met with.

All patients are not equally susceptible to the action or the oscillatory currents. Some, even after a prolonged first session with currents of very high intensity, manifest no untoward symptoms. Others seem to be more affected by their action during the first few sessions, but become more tolerant of its effects as treatment proceeds. Some few manifest a recrudescence of symptoms at every increase, either in the duration of the session or in the strength of the currents to which they are submitted. Others show but few of the symptoms during the earlier applications, but these increase instead of diminishing at sequent sessions ; and last there are those who manifest the most alarming symptoms, and cannot be brought to tolerate treatment by this method at all.

The class of patients who are more susceptible to the action of the currents, and who manifest marked symptoms of the reaction of intolerance are those of high strung nervous temperament, whose health has been undermined by the circulation of toxic products generated in the system. These are chiefly sufferers from senile rheumatism, neurasthenia, diabetes, anæmia and chlorosis. With these exceptions the majority of patients tolerate treatment by condensation better than by auto-conduction.

Graduation.—It has been already said that the strength of the current passing into the body of a patient has an important effect upon the reaction, and that its intensity is greatest when his body is an active capacity directly connected with the external armatures of the Leyden jars of the apparatus of production. The current then traversing the system will usually be found to exceed 480 m.a. Still, whatsoever may

be the manner of connection, some degree of graduation can be obtained by attention to the accessory measures detailed in Part II in referring to graduation in local applications.

Where the armatures of the couch condenser are connected with opposite poles of the solenoid of high frequency, the intensity of the current passing into the derived circuit can to some extent be controlled by adjustment of the contact regulator; but these measures can be largely reinforced by the introduction of a small coil of self-induction into the derived circuit, an arrangement which works admirably and allows of an extensive and easy regulation of effect.

Duration and Frequency of Sessions.—Owing to the difficulty of gauging the susceptibility of the patient and the untoward effects, known as the reaction of intolerance, it is usual to start treatment with a short session and increase its duration on subsequent occasions. An application of 4 to 8 minutes is sufficient at the commencement. For the same reason, it were well to keep the intensity of the current during the earlier sessions as low as possible and cautiously to increase it if events justify this procedure. A fact well worth remembering in fixing the duration of an application is that women at the climateric and during the menstrual epoch are more susceptible than at other times. No definite rule can be laid down respecting the frequency of the sessions. The operation must be guided by his observations of the results of treatment, both immediate and remote.

LOCAL CONDENSATION.—This differs not only in its technique but also in its systemic effects from the methods previously described. It has not, as yet, been known ever to provoke the reaction of intolerance. In this method of treatment the use of the couch condenser is entirely dispensed with; its place is taken by one or more of the various shaped splint-condensers* that can be readily moulded to fit the parts of the body to which they are to be applied. These splints are made of aluminium, wire-gauze, or sheet-lead, and encased, except at the points about its middle, where the connection is made, in a double layer of the composite material already described. The patient is placed on an insulated couch and connected by means of an ordinary contactual electrode with one pole of the solenoid of high frequency; to the opposite pole is attached by a suitable length of well insulated wire, the splints, which have been carefully fitted to the parts to be treated.

Reaction.—It occupies an intermediate position between simple monopolar derivation on the one hand, and general condensation on the other. Although the quantity of the currents circulating in the body of the patient undergoes an increase by reason of the inductive effects of the splint-con-

*Described in "Notes on Instrumentation."

densers, still it is never increased to the degree attained by general condensation, nor has it been known to provoke the reaction of intolerance. It is also remarkable for bringing into prominence the local concentrative effects of the currents upon the parts to which the splints are applied; for a relatively large percentage of the charge produced by influence becomes fixed and, so, limited.

Graduation.—The coil of self-induction can here, as in the preceding methods, be employed to graduate the effect. It is not, however, so essential as a fair graduation can be obtained by adjustment of the regulator of the small solenoid of high frequency.

Duration and Frequency of Sessions.—As patients treated by this method do not appear to develop any symptoms of intolerance, there is not the same need of super-vigilant caution in limiting the duration and frequency of the sessions. Starting with a preliminary session of 8 to 10 minutes, the duration may be boldly increased till 40 minutes is reached. This is the maximum. Although the generality of patients can easily be brought to tolerate a daily repetition, it need seldom be repeated oftener than three or four times a week.

(*To be continued.*)

Ali Krogius: Finska Läkaresallskäpets handlingar 1903Nr. 8.

This author reports a case of round-celled sarcoma of the cranial vault in a man, 40 years of age, which was partially removed surgically. It was found to be too extensive for complete removal of the whole of the affected part, and nine months after the operation the patient was found to have an extensive recurrence. Again the complete removal was found to be impossible, and a year later, when there were numerous nodules all over the skull, treatment by X-rays was instituted.

Treatment was continued for two months, at the end of which time the whole of the nodules had disappeared, leaving no trace of their previous presence.

Four months later the hair, which had fallen off under the treatment, had again grown luxuriantly, and there were still no traces of recurrence.

This case is of interest in that it shows that of the sarcomata, those varieties which are of very slow growth are amenable to X-ray treatment, and we ourselves have notes of a similar case, which we hope to publish in full later, when a longer time has elapsed without recurrence. The fact that the growth had lasted for three years without destroying life is evidence that the tumour was of comparatively low malignancy, and it is of interest to note that of the epithelial tumours, rodent ulcer, and cutaneous epitheliomata exhibit also this tendency to slow growth and susceptibility to treatment by the X-rays.

A FEW NOTES ON RADIUM.

By Morton Smart, M.B.,
Physician in charge of Electrical Department, Great Ormond Street Sick Children's Hospital.

A short description of the new element Radium, about which so much has been written and spoken, may be interesting at the present time, since the research which has recently taken place has proved conclusively that the discovery of such a substance is the most marvellous advance that Science has made within recent years. The discovery of the peculiar phenomenon possessed by certain substances and named "radio-activity" was initially due to the painstaking energy of Becquerel in connection with the substance Uranium. Many other observers were working in the same direction, and Becquerel's discovery of the remarkable radiations which emanate from this substance and its salts has acted as a stimulus to others, and thus a very wide field of research has been opened up, and already the result of such investigation has been the elucidation of many of Nature's closest secrets. Quite the most marvellous and most interesting result of all this investigation of radio-active bodies is the discovery by Professor and Madame Curie of the new element, Radium. Uranium, the experiments on which led to the discovery of radium, is obtained from a mineral named Uraninite, or Pitchblende. This mineral is a compound oxide containing a large percentage of uranium, and a small percentage of lead, barium and bismuth, and about one-half per cent. of iron with oxygen and water, and sometimes magnesia, manganese and silica. From this mineral, are obtained by a long, tedious and expensive process the three radio-active substances called Radium, Polonium and Actinium. The samples of pitchblende vary considerably in their radio-activity, the most radio-active specimens so far discovered being the Bohemian pitchblende. Some has also been discovered in the United States, in Saxony and in Cornwall.

The reasons which suggested the presence of some very radio-active substance in pitchblende are exceedingly interesting. The Curies of Paris were conducting a series of experiments in connection with Becquerel's radiations, and were testing the radiations from uranium minerals, by means of the gold leaf electroscope. During these experiments it was noticed that certain specimens of the uranium minerals were capable of causing a much more rapid discharge of the electroscope than could be explained by the percentage of the uranium oxide in the mineral that was being tested. This remarkable fact caused Prof. Curie and his wife to undertake the laborious work of separating the mineral into its con-

stituent parts, and testing the power of discharging an electroscope of each part separately.

The first result of this investigation was the discovery of "Polonium," an element which is akin to bismuth. This element is only found in very minute quantities, and although it is a radio-active substance it does not seem to have the power of retaining this activity for any length of time.

A third substance, named Actinium, also possessing radio-active properties, has been described as having been isolated from pitchblende, but this seems doubtful. Sir William Crookes succeeded in separating a substance from uranium, with the result that the uranium was left free from radio-activity. This substance he named Uranium X, and he affirms that the so-called polonium and uranium X are identical.

The other and most important radio-active substance obtained from uranium is radium. Radium is often spoken of as a metal, but it has not, up to the present, been produced in the pure metallic form, but only as a salt, the chloride and bromide of radium being the commonest forms. It has already been conclusively proved that radium gives off three distinct kinds of rays, all of which possess certain properties, and which vary considerably in their powers of penetration. These rays, for convenience of description, have been named "Alpha," "Beta," and "Gamma" rays.

The alpha rays consist of positively charged particles which are about twice the mass of the hydrogen atom, and they are projected at a velocity which has been measured and is equal to about one-tenth the speed of light.

These rays are very little absorbed, and therefore have very little penetrative power. It has been said that they are absolutely non-deviable, and that the bulk of the rays given off by radium is composed of them.

The beta-rays, on the other hand, are much more penetrative, and in certain respects seem to closely resemble the cathode rays. The cathode rays and the beta rays, for example, are both easily deflected by a magnet and are both able to affect a photographic plate, and to cause ionisation of gases, thus being capable of discharging an electroscope.

Professor Rutherford, by a long series of careful experiments, has shown that the penetrative powers of the rays can be measured, and the result shows the gamma rays to be far the most penetrative of the series. He measured the relative penetrative powers of the three sets of rays through sheets of aluminium of varying thicknesses, and found that the gamma rays far exceeded the penetrative power of the beta rays, and that the beta rays far exceeded the alpha rays.

By comparing the radium rays and the X-rays, each may be shown to have certain characteristics which are more or less identical.

Both kinds of rays have the power of affecting a photographic plate, and rock salt is opaque to both.

X-rays and radium rays have the power of penetrating black paper, which is absolutely opaque to ordinary sunlight. Both kinds of rays have the peculiar power of exciting fluorescence in certain substances, such, for example, as barium platino-cyanide.

Another striking phenomenon which points to their having similar qualities is that radium, when kept for any length of time in a glass tube, causes the glass to become coloured violet, and this violet colouration of the glass may also be produced in the glass of an X-ray tube which has been used for any length of time. The gamma rays, being the most penetrative of the series, may resemble the X-rays from a tube of the "hard" variety. Radium rays and ordinary light also behave remarkably like each other in several respects. They both possess the power of reducing silver and other salts, and they are both able to colour paper and glass when exposed for any length of time. Radium, like light, has also the power to stimulate the optic nerve, as may be shown by bringing a tube of radium near the temple or placing it over the closed eyelid, when a sensation of light is produced. In trying this effect, it is almost essential to be completely in the dark for some considerable time before the sensation of light is experienced, and in several cases I have found it impossible to obtain the effect. It has been recorded that this power of stimulating the optic nerve was utilized in experiments on blind patients. In those who were totally blind, the radium had no effect, but in those who retained the power of distinguishing between light and darkness, but who had no power to discern the outline of objects, the radium, when brought near the eyes in a dark room, enabled the patients to see the outlines of objects held in the field of vision. I have had no opportunity of testing the truth of this statement, but the fact that the sensation of light produced on the healthy nerve is so slight, and often difficult to elicit, makes me greatly doubt its accuracy. The above description of the three kinds of rays given off by radium may have to be very materially altered or added to as the investigation proceeds, but it gives a very fair idea of the chief opinions held at present. Radium, as well as being a radio-active substance itself, has also the peculiar power of inducing radio-activity in other bodies.

Thorium is another substance which, besides being radio-active, also possesses the property of inducing radio-activity in neighbouring bodies. This property of inducing radio-activity is possibly due to the emanation which is given off by radium and thorium. Polonium, also a radio-active substance, gives off no emanation and does not possess the power of inducing radio-activity.

When radium is exposed to the air, the induced radio-activity is lost in a very short time, but, if confined to a closed vessel, the induced radio-activity of the air remains even after several days. If the emanation from radium be carried through a tube intensely cooled by liquid air, it is found that it actually loses its activity, and that the active portion remains behind in the cooled tube. If the tube be now warmed, the active portion leaves the tube and has the power to discharge an electroscope.

It has been shown that radium has the extraordinary power of evolving heat apparently without undergoing combustion or chemical change. Its temperature is maintained at about 1·5° C. above its surroundings, and this, stated in simpler terms, actually means that pure radium salt is capable of melting its own weight of ice every hour. This production of heat apparently goes on steadily for an indefinite period, as the salt at the end of months is as active as before. Prof. Rutherford has stated that the greater part of the heating effect of radium is due to the radio-active gas which it produces from itself and not to the radium itself. A great controversy has arisen as the result of the discovery of this heat-producing power of radium, and scientists are endeavouring to trace the remarkable energy to its source, but it is indeed a problem beset with difficulties, and at present, although several theories have been advanced, nothing has actually been proved. Curie has suggested that the radium atoms transform into another simple body, and although the transformation is exceedingly slow, the amount of energy produced would certainly be enormous. Another theory is that radium may possess the power of seizing and utilizing certain unknown radiations in the ether.

Sir Oliver Lodge has suggested that the heat emission from radium may be an immediate consequence of the fact that radium emits massive positively charged particles, probably atoms, with a velocity equal to one-tenth the speed of light.

The emission of a million heavy atoms per second, which is really a very small quantity, with a speed equal to one-tenth the speed of light would represent an amount of energy which would correspond to heat enough to melt a milligramme of ice every hour. These atoms, not possessing any great power of penetration, are easily stopped by obstacles, and would therefore be mostly stopped by a small thickness of air. Thus, their energy would be expended in the neighbourhood of their source which would, in consequence, tend to be kept warm. If the rate of escape of heat, in the open, were such that on the average it accumulated for one minute before escaping, the temperature of the source and the surrounding air, with an assumed heat capacity of one milligramme of water, would amount to 1·5° C.

This theory probably explains the phenomenon better than most, but it must still be remembered that nothing has been definitely proved. The theory, most generally accepted as explaining the phenomena of radium is that known as the disintegration theory, and this explanation by Sir Oliver Lodge of the heat-producing power of radium is quite in accordance with this theory. The disintegration theory was first advanced to explain the radio-active properties of uranium and thorium, and has now been extended to explain the properties of radium, which, after all, are very similar to those of uranium and thorium, differing in the fact that radium acts so much more powerfully.

The theory, stated briefly, is that a slow breaking up of atoms is continually taking place, and resulting in the formation of other elements, and that during this process of breaking up of atoms, various "rays" are given off at the different stages. This constant succession of changes results in the spontaneous projection of masses of material at enormous velocities, and certain portions are constantly becoming inert and other portions are constantly increasing in power. The teaching of chemists, until the discovery of uranium radiations, was that an atom was not further divisible, but this idea has been given up on account of the evidence which has been gathered in favour of the disintegration of atoms which goes on continually in radio-active bodies. Radio-activity, when it has once commenced, seems to be able to resist all endeavours to stop it; it has been shown that heating and cooling have no effect. Radium has been cooled down to the temperature at which hydrogen ceases to be a gas, and yet the radio-activity still goes on.

It was stated at a meeting of the British Association that if a square centimetre of surface were covered by pure radium, the loss of weight in a million years would only amount to the one-thousandth part of a milligramme.

Several investigators have endeavoured to work out the question of this loss of weight, but such investigations are extremely difficult, for many reasons; and, after all, can only be theoretical, as it is probable that a portion of the mass calculated as material is apparent, and corresponds to the effects of induction.

The atomic weight of radium is said to be 225, but it is extremely probable, owing to the difficulty of obtaining pure radium, that the sample analysed may not have been quite free from barium, and it is a fact that there is evidence from the spectrum analysis that the atomic weight may really be higher. Uranium has an atomic weight of 240, and thorium is 232. It is curiously suggestive that the atomic weights of these three substances, which have such decided radio-active properties, are the highest yet known, and it will be interesting

to see if radium, the most powerfully radio-active substance, does not ultimately prove to have the highest atomic weight.

It had several times been pointed out that the gas "helium" was closely associated with uranium and thorium, and this led Rutherford and Soddy to suggest that its presence might possibly be due to the radio-activity of these bodies. Helium is a gas which was discovered and described by Sir Wm. Ramsay, who showed that it is an inert gas analagous to the gas "argon," and is contained in certain minerals. He conducted a series of experiments with a view to finding out whether or not helium was in any way connected with radium, and was rewarded by the discovery that the emanation from radium actually becomes slowly transformed into helium. The fresh emanation from radium does not show the spectrum of helium at once, but it undergoes certain changes which end in the production of helium—in other words, the emanation seems to *decay*.

Of the long series of marvellous phenomena which have been discovered in connection with radium, this is probably the most remarkable, because it is an actual demonstration of one substance changing into another. It opens up another wide field for investigation, and although speculation is at present useless, there is a possibility that all other substances are undergoing similar changes. It may be that there is a definite limit to the atomic weight of an element, and that this is only an example of a substance of high atomic weight being quite unstable on account of the actual weight of the molecules themselves.

The atomic weight of helium is only 2. If other elements are going through a similar series of changes, that is to say, if all bodies of high atomic weight are breaking up into other bodies of low atomic weight, the thought that naturally arises is that could a means of reversing the process be discovered the problem of the transmutation of metals is an accomplished fact. The discovery, in fact, suggests numberless possibilities and the investigations of the future in this direction may elucidate even more startling facts. As Darwin proved that all living things were evolved from a single origin, so may it yet be proved, as some scientists already believe, that all different forms of matter have a single origin. It was predicted some time ago that under certain conditions one element might possibly be shown to break up and throw off particles of itself recognisable as other elements. Plant and animal life have been traced, step by step, to a single form, and it may yet be possible to show that all known materials are also traceable to a single form, and are collections in different numbers and groups of this simple unit which may ultimately be proved to be that infinitely small particle called an electron. That is to say, that groups of these small par-

ticles form one element, and that arranged differently they form another. All such speculation is the immediate result of the discovery of the transformation of the emanation from radium into helium.

Within the last few months the belief is gaining ground that every known substance may yet prove to have more or less radio-active powers, and the investigation of many substances gives support to this belief. If a metal wire be heavily charged with negative electricity it becomes radio-active, and this radio-activity can be scraped off and will affect a photographic plate. The leaves of trees and falling rain and snow are said to be radio-active. It is quite possible that such radio-activity is obtained from the atmosphere, and in support of this it may be instanced that after a fall of rain or snow a wire negatively charged in the atmosphere is only slightly radio-active in comparison to the radio-activity produced in a similar manner before the fall of rain or snow. The water found in deep wells has been shown to be radio-active, and also the stone walls of buildings, and even the earth's surface. The newly described N-rays seem to point to the human body being radio-active.

Besides all these wonderful chemical and physical properties, radium also possesses very powerful physiological properties, which, if not borne in mind, may do serious damage.

It has been estimated that to be shut up in a room with two pounds of radium in the pure state would result in the severe burning of the skin, destruction of the eyesight, and very severe effects on the nervous system ending in paralysis and death!

Most people already know that radium is an exceedingly dangerous substance to carry about, if unprotected, as there have been several cases recorded where severe burning of the skin has been the result. The burning of the skin, curiously enough, does not make its appearance till some days after the exposure to the radium, and the ulcers formed are most difficult to cure. This effect is somewhat similar to over-exposure to the X-rays.

Experiments have been carried out with a view to determine the effect of radium rays on different forms of bacteria, but the results have not so far proved very encouraging, although certain micro-organisms are destroyed by long exposures.

A few milligrammes of radium injected under the skin at the back of the neck of a mouse is sufficient to cause a series of serious symptoms. The neighbouring parts become hyperæmic and the mouse becomes torpid, paralysed and insensible, and dies on the fifth or sixth day. The public has displayed a feverish interest in radium mainly due to the hope, stimulated by irresponsible newspapers, that at last the means of curing

cancer has been discovered. It is still much too early to make any definite statement on this important point as reliable information is so difficult to obtain; and also because the experimental stage must of necessity be a long one. Possibly there is no doubt that radium has proved itself to have some therapeutic value in such cases as the X-rays have also proved effective; for example, in rodent ulcer and other superficial cancerous lesions of the skin. At the same time, it has not been by any means proved that radium has done more for such cases than the X-ray treatment would have done. The beta rays of radium are said to be akin to the cathode rays in an X-ray tube, so that there is probably this much in common sufficient to cause a similar therapeutic effect. Should, however, it be proved that the gamma rays possess any decided therapeutic effect, it may possibly be shown then that radium does possess more therapeutic power than the X-rays, inasmuch as the "gamma" rays are so very much more penetrative than the "beta" rays. In discussing thus shortly the possible therapeutic value of the rays, it may be pointed out that the "alpha" rays have been ignored, as they have so very little penetrative power, and can therefore hardly have any therapeutic effect on the tissues.

I am at present carrying out a series of physical and physiological experiments with radium, the results of which I hope to publish at some future date.

COMMENTS AND ABSTRACTS.

The Section d'Electricité Médicale of the French Association for the Advancement of Science, held at Grenoble last month, has been productive of a large number of interesting contributions. The reports of the work have been practically all accompanied by exact details of treatment, including a record of the amount and strength of the application registered by the radiochromometer, etc. This greatly enhances the value of the records for the purpose of critical study.

It is impossible, in the space at our disposal, to do justice to all the papers read at this conference, for fuller details of which we would refer workers in this branch of medicine to the *Archives d'Electricité Médicale.*

M. Belot and MM. Delherm & Laquerrière presented papers on the treatment of pruritus of various natures, by means of X-rays. A very small number of sittings seem to have been necessary in the practice of these authors, about four to six, in order to permanently and completely ameliorate these most distressing disorders.

They quote one case in which X-rays after about a dozen sittings proved efficacious after high frequency had been applied for three years without any result.

M. Augé contributed an interesting communication on the treatment of lupus by radiotherapy, recording good results even in fairly advanced cases.

M. Bordier reports a case of capillary nævus treated by phototherapy. The patient was a young girl with several broad patches on the cheek, and the whole of the nævus disappeared after three or four sittings for each portion covered by the compressor.

The same author, in collaboration with M. Bonnenfant, has been experimenting on the effect of high frequency currents on growth. He finds, using young rabbits as subjects, that there is distinct retardation of growth, and that in adult animals there is distinct loss of weight, while the heat output is sensibly diminished.

M. Haret records some cases of epithelioma treated by radiotherapy. One case is of special interest, being one of an epithelioma of the floor of the mouth, in which this author was successful in obtaining disappearance of the primary lesion and also of the secondary glands. He records also cases of epithelioma of the vulva, of the nasal cavity, and a case of recurrent carcinoma of the breast with cutaneous nodules.

M. Albert Weil brought forward a case of chronic constipation, which had been intractable to the usual medication, but which readily yielded to radiotherapy.

SCHLEUSSNER'S
SPECIAL
RÖNTGEN PLATES.

The Finest Procurable for X-RAY WORK.

The following are a few Testimonials (among many) which should convince all Medical and Scientific Men of the value of these Plates for Special Work:—

Prof. Dr. A. HOFFA, Institute of Orthopædic Surgery, Würzburg:—"Have used your dry plates for many years, especially for Röntgen-Ray work, and have always found them highly satisfactory."

E. H. HOWLETT, Hull:—"The best plates I have ever tried for Röntgen-Ray work."

Prof. Dr F. KRAUSE, Chief Surgeon, Municipal Hospital, Altona:—"Our Röntgen-Ray photographs have been exclusively taken with these plates, and they have always behaved excellently."

These Plates may be obtained from Photo. Dealers, or from the Sole Agents for Great Britain:

THOS. CHRISTY & CO., 4, Old Swan Lane, LONDON, E.C.

MEDICAL

Electrology and Radiology.

No. 10. OCTOBER, 1904. Vol. V.

EDITORIAL.

The early death of Niels Finsen came as a shock to all who have followed the progress of his discoveries, not only among the ranks of the Medical profession, but also among the general public, although to all who have watched the history of his failing health it came hardly as surprise.

Although only 43 years old he achieved a work which will stand for all time, done like so much of the finest of the world's work under circumstances of the greatest disadvantage. In spite of his failing health he carried on his investigations with indomitable perseverance, and to him was granted that privilege, so often withheld, of seeing his labours crowned with success and his methods generally adopted.

His own personal advantages were never a point which entered into his consideration. He was always a poor man, and even when awarded the Nobel prize it was only with difficulty that he was dissuaded from giving the whole of it to his dearly-loved Institute, and was at last constrained to keep half for the benefit of himself and his family.

It has not been the good fortune of many in this country to have at their disposal an installation as complete as the one which he himself used with such success, owing to its costly nature and to the space needed for its accommodation.

It is this point which has stood in the way of the more universal adoption of his treatment. There are a great many forms of apparatus in use, but these seem to yield results much inferior to those obtained with the original apparatus, and it remains to the future to prove whether the same results

can be obtained with some modification equally efficient, but less costly and more rapid in its action.

However this may be, the discovery of Niels Finsen will always mark an epoch in the treatment of lupus, for it is to him that we are indebted for a method which is applicable to cases which were before out of the reach of the surgeon, and which, while they had but little effect on the duration of the patient's life, yet made that life a burden to him, and prevented him from following his daily work among his fellow men.

The difficult question of the measurement of the interrupted currents used for diagnostic purposes is again receiving attention, and it is probable that a means of overcoming the difficulties of the problem may shortly be arrived at.

We print this month an abstract of an important contribution on this subject by Dr. Stéphane Leduc, Professor of Physics in the Medical School at Nantes. It describes the use of a motor-driven commutator for the production of interrupted currents, and points out the advantages over the induction coil which this method presents. We understand that Dr. Lewis Jones will shortly exhibit Leduc's apparatus at a meeting of the British Electrotherapeutic Society, and will describe the oscillograph tracings of induction coil currents which were shown by him at the British Medical Association meeting at Oxford last July.

Owing to the indisposition of the American Editor, the Digest of American Literature will not appear till next month.

A STUDY OF INTERMITTENT CURRENTS OF LOW TENSION.

By Dr. Stéphane Leduc.

(Abstracted from the *Archives d'Électricité Médicale*, Sep. 15th, 1903.)

Intermittent currents might be used with advantage in medical practice to take the place of induction coil currents. They can be made to serve all the purposes of the latter, and this, too, in a more perfect manner. They are better adapted for diagnostic uses because their magnitude can easily be measured, whereas all attempts to measure induction coil currents in a satisfactory manner have been unsuccessful. It is also possible, with the apparatus I am about to describe, to vary the frequency of the impulses, that is to say their number per second, and also to vary the duration of each

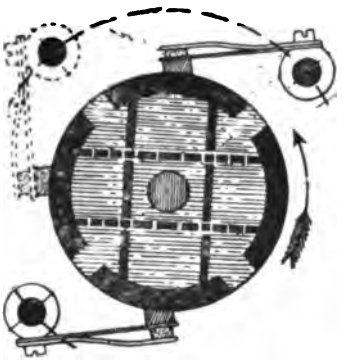


Fig. 1. Commutator of Leduc. The dotted lines represent the direction of displacement of the moveable brush.

individual impulse while still preserving the frequency unchanged.

Both of these factors are of considerable importance, not only in diagnosis, but also in treatment. Hitherto the measurement of the time elements of interrupted currents has only been attempted in laboratory experiments.

To obtain the interrupted currents I use an interrupter driven by a small motor. An insulated disc is mounted upon the axle of the motor, and is fitted with four metallic segments, the opposite segments being connected together to form two pairs. (Fig. 1.) A pair of brushes is provided, and the circuit is closed from brush to brush through the segments. If the contacts of the brushes with the two segments composing a pair occur simultaneously, the current is only interrupted during the short moments during which the brushes are passing over the intervals which separate adjoining segments. One brush is fixed and the other is moveable through an arc of 90°, and by a displacement of the moveable brush one can so arrange matters that the circuit only becomes closed when one seg-

ment of the pair has already performed a half, three-quarters or more of its passage under the fixed brush, in which case the current can only get through during one-half, one-quarter, or less, of the whole period. The speed of the motor is regulated by a rheostat and this determines the number of interruptions in a given time. The speed of rotation can be measured directly by a speed counter on the axle. A milliampèremeter in the circuit measures the current, and it is necessary to compare the readings indicated when the motor is in movement with those indicated when it is at rest. The latter give the true value, and the former can be used as a measure of the duration of the time of passage of the current during each period, for if the current passes during one-tenth of a period and is "off" for the remaining nine-tenths the current registered by the milliampèremeter will be the tenth of the true current, and so on. By this use of the milliampèremeter one can estimate the duration of time during which the current is flowing.

The time element with interrupted currents, has not hitherto been measured in medical practice, and yet the importance of this factor seems pre-eminent. A current with a hundred periods or interruptions per second, and passing during one-tenth of each of these periods, that is to say during times measuring one-thousandth of a second, gives a minimal contraction in the muscles with seven volts when applied over the ulnar nerve at the internal condyle of the humerus. By progressively varying the duration of flow between the limits of one-thousandth of a period and nine hundred thousandths of a period a chart of the voltage necessary to provoke a minimal contraction can be prepared. The results gained are expressed numerically in the table subjoined, from which one sees that the duration of the periods of flow has a very great influence upon the volts necessary to cause a minimal contraction, so much so that the range in the table is from seven volts to twenty-two. The pressures necessary reach their minimum at seven volts with a current duration of one-thousandth of a second. For shorter durations higher pressures are found necessary, and for longer durations somewhat higher pressures are also necessary.

Duration of Current Flow. Seconds.	E.M.F. necessary for Minimal Contraction. Volts.	Duration of Current Flow. Seconds.	E.M.F. necessary for Minimal Contraction. Volts.
0·00001	22·0	0·00100	7·0
0·00010	15·0	0·00200	7·5
0·00020	13·5	0·00300	8·0
0·00030	12·0	0·00400	8·5
0·00040	11·5	0·00500	9·0
0·00050	10·5	0·00600	9·5
0·00060	9·5	0·00700	10·0
0·00070	9·0	0·00800	11·0
0·00090	8·5	0·00900	12·0

What is the factor which determines this minimum of volts necessary to produce a certain contraction? Is it the relationship between the time of flow and the time of no flow during each period, or is it the absolute value of the duration of flow? To determine this question I have drawn up a table of the pressures necessary for producing a minimal contraction when using a periodicity three times greater, namely, with 300 interruptions a second, and I have found that the least voltage no longer corresponds to durations of flow of one-tenth but comes out at three-tenths of a period, that is to say that it continues to coincide with a duration of one-thousandth of a second of actual flow, and a table of pressures when the slower periodicity of 40 interruptions per second is used also tends to confirm this view. It therefore seems probable that with interrupted currents the electro-motive forces necessary to produce a given strength of contraction depend upon the absolute duration of each of the individual impulses of current, and that the best duration period is about the one-thousandth of a second. From what we know of muscular contractions in morbid states we may expect that measurements, of this kind, of the duration of the periods of flow of an intermittent current might be used to give us a means of estimating the extent of disease in a nerve or a muscle, for in proportion as degeneration progresses in a muscle so does it require longer and longer periods of flow before responding with a contraction. But hitherto none of us have been able to make any measurement of what these durations required to be. It is needless to insist upon the importance of an easy and precise way of measuring durations of flow when working with intermittent currents. I am sure that we should be able to estimate degrees of degeneration if we could measure the duration periods of the current necessary to set up contraction.

By making an experiment on a muscle with the motor starting from rest and gradually increasing in speed, I have found that the long durations which correspond with the slow movement of the motor give weak contractions, but that as the speed of the motor increases and the duration times diminish the amplitude of the contractions becomes larger till a maximum is reached, in spite of the fact that the duration times of flow decrease as the speed increases. Finally, speeds can be reached which are so rapid and give such short durations of flow that their power of causing muscular contraction begins to diminish and finally disappears. As in this experiment the relation between duration of current and of interruption remains unaltered, it shows clearly that excitation depends mainly on the absolute duration of each time of flow. If the current be cut off from the motor it gradually slows and stops, and the same effects can be again observed in inverse order. In this experiment the number of interruptions

varies as well as the durations, but the former experiment in which the number of interruptions remained invariable tends to prove that the volts necessary for a given degree of excitation depend upon the durations of flow, and that consequently for a given voltage the exciting action depends also on the duration of flow.

We may also obtain direct proof of the influence of the duration of flow apart from any change in the number of intermittences per second by displacing the moveable brush while the motor is running at a steady speed. As already described a displacement of the brush prolongs the period of no current at the expense of the period of current flow. On making the experiment the contractions increase as the duration of flow increases, and finally decrease when it becomes very long.

If the intervals of no current are made very brief the effect ceases to be that of a tetanising current, and the interrupted current gives contractions only at closure like those produced by a continuous current. In other words,—and this is the establishment of a new physiological fact of great importance,—in spite of the fact that the number of intermittences, that is to say of exciting shocks, remains constant, it happens that when the durations of the intervals become very short the intermittent current acquires the properties of a continuous current.

It is not the longer duration of current-flow which produces this effect, for when the duration of current-flow is prolonged by slowing the speed of the motor, the same modification is not obtained because in this case the duration of the intervals of no current is prolonged equally with the duration of flow. I have verified this observation by many experiments. It is when the interruption or time of no current between each impulse lasts for about one-thousandth of a second that this phenomenon is most marked.

My experiments also show that for periods of flow which are infinitely short, even large currents are unable to cause any excitation of muscles or of nerves.

In some other experiments I have noted that the effects of an intermittent current vary with the relative positions of the subject and the interrupter in the circuit. This is not so with a steady current, but as soon as we deal with variable currents differences can be recognised between the different points of the circuit, and these depend upon the relative positions of the active electrode, of the resistances, and the points of interruption. These are points which have hitherto been entirely misunderstood, but they demand the attention of physiologists, because they all have an influence on the effects observed. If we consider the case of an active or testing electrode kept connected to the negative pole of a

battery it is clear that this electrode remains at a steady negative potential, whereas the other or indifferent electrode connected to the positive pole through the intermediary of an interrupting mechanism is not so, for when the circuit is open at a point between the battery pole and the indifferent electrode the polarity of the active electrode does not alter, and the current which excites the nerve at closure of the circuit is started by the change of potential at the indifferent electrode. It follows from this that a nerve can be stimulated, although kept at a constant potential. If the circuit were opened between the testing electrode and the battery, the subject would be positively charged up to the moment of closing the circuit, and this would change at the moment of closure to a negative pressure, and thus the point tested would undergo a change of potential from positive to negative, which would be equal to double that of the E.M.F. of the battery. The current, however, would be no greater than in the former case. Formerly it was thought that the excitation of the nerve depended upon current alone, and that for a given current the same excitation was produced, no matter whether the potential at the point tested remained constant or not, but the experiment just described shows that this is not the case, and that the degree of excitation produced by a given current is greater or less, according as the variation of potential at the point tested is greater or less. If by means of a simple apparatus the relative positions of interrupter and subject are reversed it is found that the effect of excitation at the active electrode is always more marked when the closure is made between the active electrode and the battery, and is always less when it is made between the indifferent electrode and the battery.

MOUTIER, *Archives d'Électricité Médicale*, September 25th, 1904.

This author has been experimenting on the treatment of arterio-sclerosis by the high frequency currents since 1889.

Improvements in the form of the apparatus have been followed by corresponding improvements in the results, but even with the older and more imperfect forms of apparatus, diminution in the arterial tension was noted. With the recent improvements in the instruments, a diminution in arterial pressure up to 6 cm. of mercury has been noticed a few minutes after the commencement of the session.

After the session this mounts up again, approximating, but not reaching, the previous height, while every successive application brings the final tension nearer to the normal. Subnormal pressure was practically never observed, 155 mm. of mercury being taken as the normal.

The value of the paper is much diminished by the absence of notes of clinical progress.

GAIFFE'S NEW APPARATUS FOR X-RAY WORK AND HIGH FREQUENCY CURRENTS OF GREAT INTENSITY.*

The essential features of this apparatus are that it is worked directly from the alternating main, or through a motor-alternator when the main supply is continuous; it has no interrupter, and the output seems to be far in excess of that obtainable from such apparatus as are ordinarily used.

Till now it has been almost impossible to make use, either in high frequency or in X-rays, of alternating currents without passing through the medium of an interrupter, because—

Firstly, the transformer, to the 50 or 60,000 volts required, is difficult to make;

Secondly, using them with high frequency puts them *hors de combat* and the output is difficult of control.

The use of a transformer with an open magnetic circuit provided with an interrupter, commonly called Ruhmkorff coil—though it was connected with the numerous worries inherent to that apparatus—had the advantage of enabling us to obtain high tensions with a very highly insulated secondary winding, but the risk of the coil breaking down was always present, as is proved by the somewhat large number of Ruhmkorff coils, having been put *hors de combat* whilst working at high frequency (wireless telegraphy or X-rays).

In order to allow us to employ transformers of an alternating current of 60,000 volts for the production, *without interrupter*, of currents to be utilized in medicine and in wireless telegraphy, we had—

Firstly, to completely modify the mode of making these apparatus in order to considerably increase their insulation whilst still retaining their industrial construction;

Secondly, to study the causes of the deterioration of transformers working with high frequency and counteract it;

Thirdly, to study the tendency to arc, so as to be able to do without the subsidiary apparatus hitherto used: magnetic blowers, wind bellows, rotary bellows, etc.;

Fourthly, to obtain in spite of the use of transformers with an alternating current and without interrupter, long and gentle effluves instead of the usual brilliant and hard aigrette;

Fifthly, to produce in a practical manner X-rays with the alternating current, availing ourselves of the ordinary properties of transformers, such as ease of regulation, regular action, and especially to place at the service of radiology the easy and exact methods which it is possible to adopt with this truly scientific instrument.

I.

Our first aim has been easily realised and the transformers of 60,000 volts of Messrs. Gaiffe have a greater insulation than the ordinary insulations of the Ruhmkorff coil.

---

* *Archives d'Electricité Médicale.*

II.

Messrs. d'Arsonval and Gaiffe have devoted themselves to the task of finding out the causes of the deterioration of Ruhmkorff coils. The Hertzian waves arising in high frequency circuits are also produced in all the conductors which are connected, either directly or indirectly, with them. The result of this is that the waves, whose length is inconsiderable and whose highest tension is equal to that produced in the spark gap, recoil in the high tension generator, creating between the neighbouring wires of the winding differences of potential much greater than that for which the transformers had been wound. These waves get weaker in proportion to their progress in the coil. If the insulation of the two extremities does not resist, short circuits are created rendering a portion of the wire useless by carrying the dangerous tensions more back towards the centre.

In order to deaden these oscillations, Messrs. Gaiffe and d'Arsonval have made use of the combination of a condenser placed exactly on the terminals of the transformer and of two resistances inserted between the transformer and the high frequency condenser on which the spark gap is placed. The object of this apparatus is as follows : the resistances deaden, by the Joule effect, the recoiling waves proceeding from the high frequency system. The condensers form a kind of reservoir from which the electricity can flow only in a progressive and comparatively slow manner on account of the resistances placed in the circuit, so that each variation of difference of the potential of the spark gap produced by the oscillating discharge only communicates a very weak variation of difference at the terminals of the transformer.

The Gaiffe transformer therefore works normally like an industrial transformer, with no sudden jerks and with no possibility of the high frequency oscillations being able to spread to the interior of its winding.

This arrangement precludes all possibility of danger; this has been proved in experiments carried out with greater powers than those at work in this apparatus.

These powers cannot easily be attained in current practice as the tension developed is greater than is needed to work the X-ray tubes, and the quantity obtained by applying high frequency to patients is such that the patient who only feels the current by the warmth produced by the Joule effect could not stand more of it.

In all that precedes there has only been the question of the preservation of the high tension secondary of the transformer, describing by a single word the inductive effect. Now this effect is not negligable ; it creates in near circuits waves of high frequency and high tension which can often be transmitted by the primary of the transformer right to the generator of the alternating current, thus placing it in danger. The apparatus in question stops the waves before they can enter the secondary, at the same time protecting all the parts of the apparatus directly connected with or which might be affected by the secondary.

III.

The blowing of the arc in high frequency installations, either on an alternating current or on powerful coils, is a problem which, till now, had not been solved, except by apparatus acting directly on the spark of the spark gap, which, if it suppressed the arc, had the effect of shortening the spark, and preventing its passage as soon as it was attempted to separate the points. Professor d'Arsonval, having noticed that the arc was more easily produced when the self-induction of the high frequency current was greater, devised the plan of placing like a branch on the spark gap a condenser or capacity (*condensateur souffleur*), and reducing to a minimum, by means of the shortest possible conductors, the self-induction of this fresh circuit.

The immediate disappearance of the arc in the spark was the result, and it was possible to obtain great tension between the points of the spark gap without experiencing the "blowing," which prevented the production of the spark.

On more closely examining these results, Messrs. d'Arsonval and Gaiffe found that they were due to the new capacity, which, by augmenting the instantaneous output of the transformer sufficiently lowered the voltage at the terminals of the latter by means of the circuit resistances, so as to make the "persistence of the arc" an impossibility.

This same result is obtained by having protecting resistances, which keep back the charge of the condensers very slightly yet sufficiently to lower the voltage at the terminals of the spark gap, and thus to prevent the tendency to arc.

IV.

The character of the spark by this new apparatus gives great tension to the points of the spark gap, thus producing longer and more gentle effluves instead of the brilliant and hard "aigrettes" of the older apparatus.

V.

The Villard apparatus is the one used to work the X-ray tubes; condensers limiting the output, valve tubes branching off from the tube, which absorb one wave and enable the other to illumine the tube. The facility with which the spent energy is varied in the tube, only by varying the resistance interposed in the primary of the transformer, would have been sufficient to create a preference for this method of action over the interrupter and coil.

The measure of the voltage in the primary of the transformer gives an idea of the voltage used on the tube, but gives no information either of the quality or of the quantity of the rays.

It seemed to M. Gaiffe that if to this measure there were added the measure of the intensity of power or the mean (it is this latter which has been adopted) which circulates in the tube the necessary elements would be to hand to exactly define the condition of a tube. The result of experiments was conclusive; it proved—

1. That for the same tube, as soon as the electro motive force and the mean intensity are the same, the quantity and quality of the rays emitted are the same;

2. That in two different tubes of the same kind of anti-cathode, of the same voltage and the same milliampèrage, the

same quantity and quality of rays correspond (to the quantity absorbed by the glass near);

3. That it is possible to draw up a table giving the corresponding penetration, compared to the radiochromometer, for an installation working on a defined source.

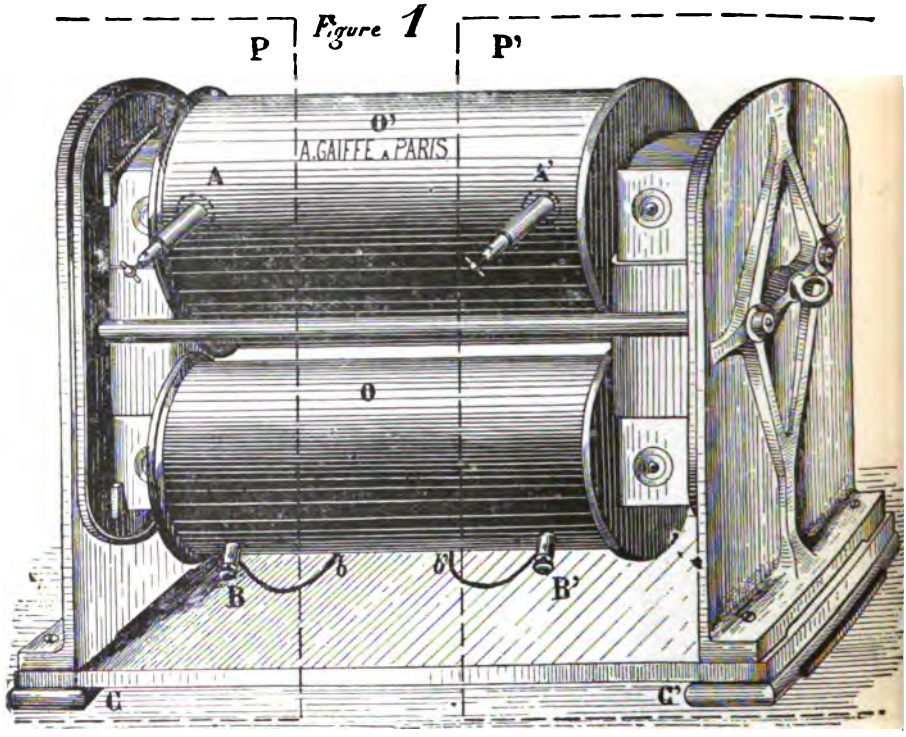
The above are merely indications of the value of the great progress which has been made and will now be further developed

after a description of the apparatus invented by M. Gaiffe, which combines all the improvements described above in theory, has been given.

The whole apparatus consisting of transformers, regulating apparatus, condensers, and spark gap is enclosed in a case of oak or walnut, the general appearance of which is given by fig. 1.

Inside the case are placed the transformer, the condenser, the protecting resistances, and the condenser which can be used either as a condenser of high frequency or as a condenser limiting the output if used for the X-rays. (Villard system.)

Figure 1



On the marble slab of the case are the terminal limits WW^1, where all the apparatus for use is fixed, whatever kind of work is being done, the silent spark gap for high frequency, and the rheostat on the face of the marble on which are fixed :

1. A large alternating, exceedingly accurate voltmeter, which registers the volts at the primary terminals of the transformer ;

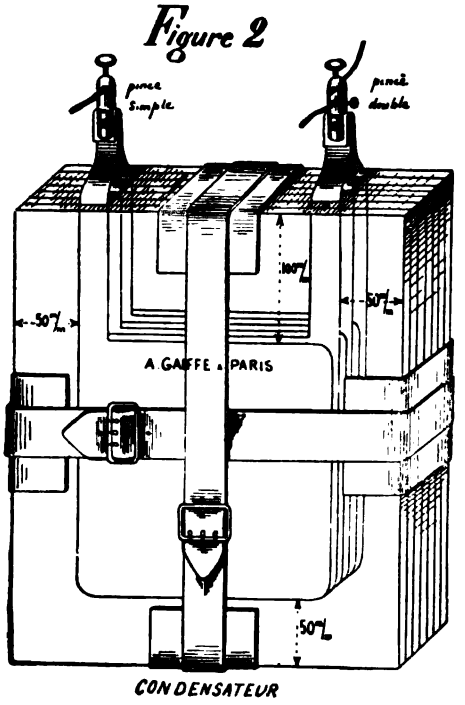
2. An ampèremeter, the handle of the rheostat regulator, the commutators, the fuse-blocks, and the terminals, etc.

The whole apparatus is completely self-contained, and when once set up and duly connected the doctor has only to adjust the

apparatus for use in order to be able to work his installation with a minimum of trouble.

We would specially draw attention to the action of the door of the apparatus, which is so constructed that opening it or closing it cuts off or turns on the current to the transformer so that, when the door of the apparatus is open, the circuit is opened and one cannot be left in the presence of a wire of high potential (60,000 volts) whilst communications are examined or established. In addition, the door of the case being glazed with small panes,

Figure 2



allows of the working of the apparatus being watched at any moment.

By carefully and accurately following the instructions we give, it is very easy to put the whole affair in working order without changing the order of the mounting of the apparatus.

Care must first be taken to separately verify each separate part of the machine so as to correct any slight disorder, which might perhaps be caused by carriage from a long distance.

The items should be as follows:

1. The transformer (fig. 2). Care should be taken not to lift it by its terminals AA^1 nor at the terminals of its primary BB or

the ebonite cylinders OO. It should always be carried by its iron frame. The transformer must never be attempted to be worked outside the case nor before the machine is entirely set up.

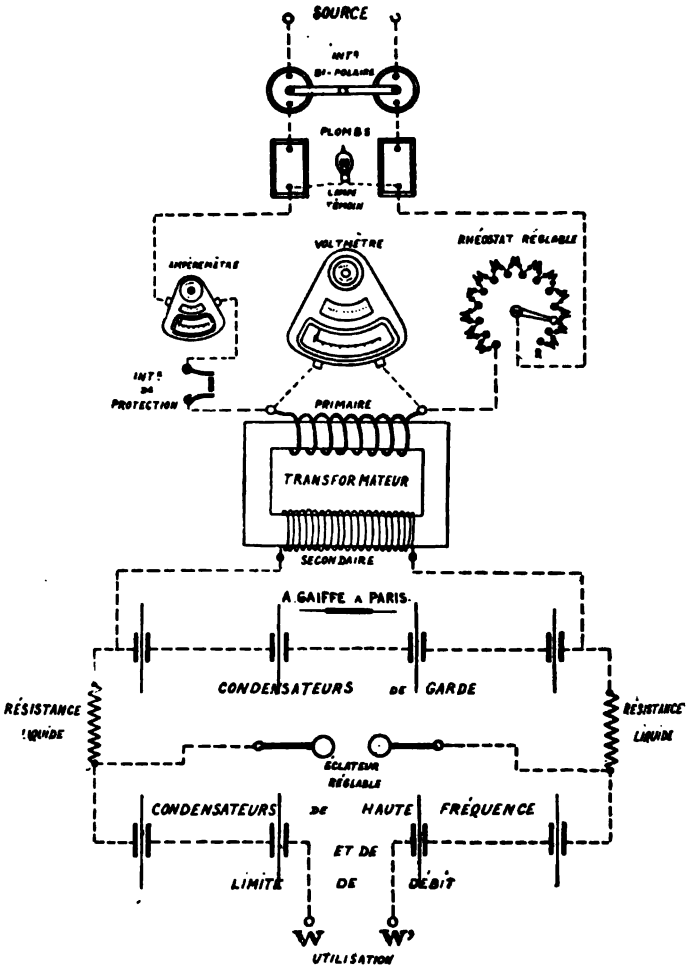


Schéma des connexions intérieures

2. The condensers (fig. 3). They must be quite exactly adjusted as represented in the illustration, according to the figures marked. As plate glass has special electric qualities, it is impossible, under any circumstances, to replace them by ordinary glass.

The figures 4, 5 and 6 respectively show (4) the general scheme of the installation, (5 and 6) the manner in which the machines of the apparatus are arranged inside the wooden case.

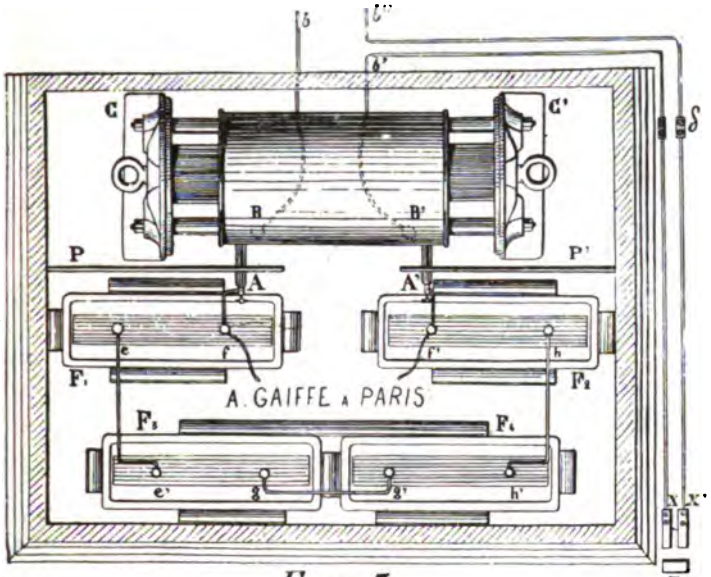


Figure 3

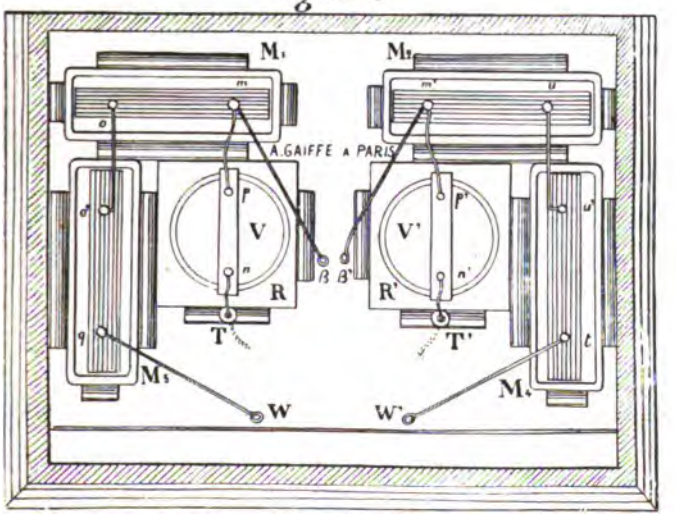


Figure 4

Fig. 4 shows the terminals attached to the current generator, the bipolar commutator, the safety strips, the rheostat, the ampèremeter and the voltmeter in derivation to the terminals of the

primary of the transformer, the transformer itself, the safety condensers directly attached to the secondary, the liquid resistances,

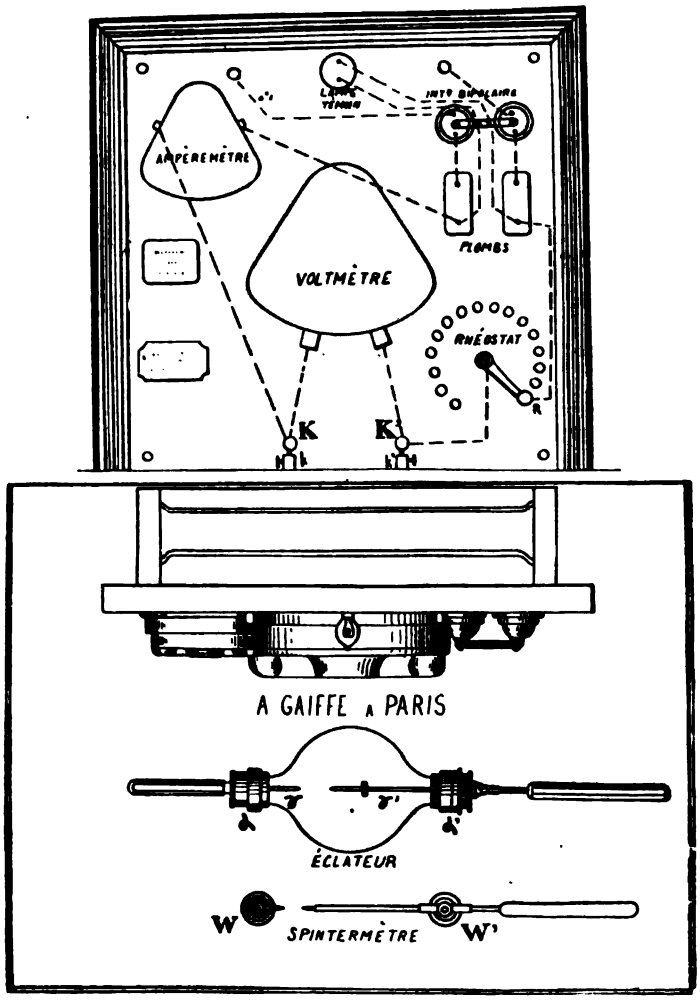


Figure 5

the *condensateurs* (capacities) of high frequency or of limit of output and the terminals of utilization WW^1.

Fig. 5 gives a plan of the lower shelf of the apparatus and fig. 6 that of the upper shelf, showing the connections between the transformers, the capacities, resistances, etc.

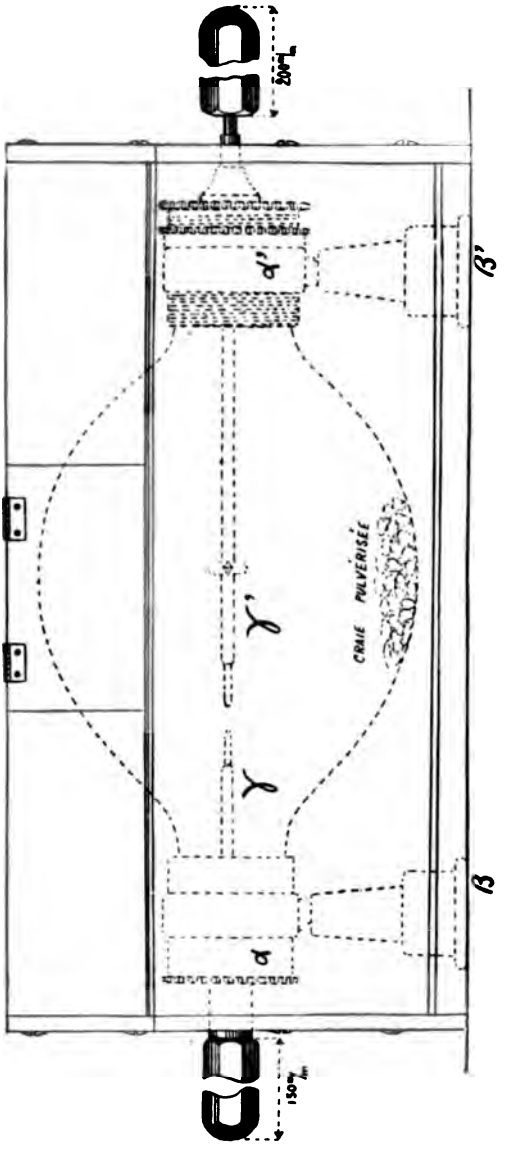


Figure 7

On fig. 5 the springs XX and the point of contact Z are shown, which is connected with the door and breaks the circuit when the door is open. On fig. 6 the terminals WW of utilization and the wires BB going to the spark gab.

Fig. 7 shows the top of the marble slab and the plan of the rheostat with its measuring and safety apparatus. The same figure shows how the rheostat H is fixed above the marble and fastened electrically by the terminals KK to the case.

Fig. 8 shows details of the silent spark gap with its rings as fixing in the pieces $\beta\beta$ of the top of the case, the points of the regulation of the spark gap $\gamma\gamma$ which is regulated by means of the ebony handle on the right, its glass cover which deadens the noise and the powdered chalk, placed inside, which absorbs the nitrous vapours caused by the spark.

The handle on the left can be quickly removed to do away with the spark gap if using X-rays; finally the cover of the whole conceals the light of the spark whilst allowing the spark gap to be observed through the door shown in the illustration.

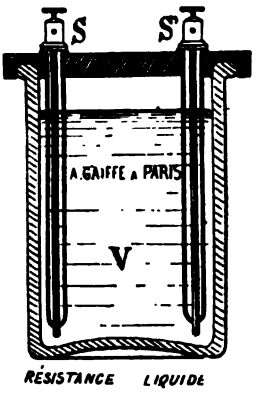


Figure 6

Fig. 9 shows in detail the liquid resistances. It is impossible within the limits of an article like this to enter into the details of installation as in the book of instruction, but the great number of figures given shows the care Messrs. Gaiffe devote to instructions and the very great facility afforded to those using the machine, as well as the impossibility of anything being changed in the working of the apparatus.

We have said that the machine can be used for two purposes: for high frequency as well as X-rays.

Suppose the machine is set up: what must be done to adapt it to either use? By simply attaching to the terminals WW^1 the apparatus for utilization according to figs. 1, 2, 3, 4, 5, 6 of fig. 10, being careful to draw back the left rod of the spark gap (see above) when X-rays are required and to replace it when requiring high frequency, then to close the circuit and regulate the current by means of the rheostat. Nothing could be simpler.

It will evidently be necessary to adjust the length of the spark at the spark gap if high frequency is required and to adjust the length of the tubes if X-rays are wanted, but this would be necessary with all other installations which would in addition necessitate either the adjustment of the break and its upkeep if a coil is in question or else the cleansing of the plates when a static machine is in question. In any case it would not be possible to obtain so high a degree of power as in our new installation.

We will now proceed to examine in detail the results obtained by this machine.

High Frequency.

In auto-conduction (No. 4 of fig. 10) the powers of induction of this machine are, compared with a coil of 50 centimetres of spark and a rapid interrupter like the *contre-moulins* Gaiffe or a mercury interrupter, as 1·8 is to 1, that is to say the power is nearly doubled.

In condensation on the couch (No. 6 of fig. 10) it is easy to obtain 900 to 1,000 m.a. The patient has a feeling of warmth at the wrists, due to the Joule effect (represented by formula RI^2), whilst he feels absolutely no current at the points where it enters the body (the hands holding the large handles).

A patient on the couch being subjected to a powerful current, can be massaged by effluves by simply touching him with dips of the fingers or a metal brush; it is an auxiliary to electrisation by condensation.

In direct applications (No. 3 of fig. 10) it is possible to get 500 to 600 milliampères holding the large handles; the feeling is the same as in condensation. By the application of large metal plates to the body the current can be moved further without difficulty.

In resonancy with the d'Arsonval bipolar coil (No. 2, fig. 10) effluves of 20 to 30 centimetres can easily be obtained. These effluves have the same properties and the same appearance as those arising from the coils, with a much greater quantity, are gentle and the most sensitive patient can stand them.

In a resonance mounting with the Oudin resonator (No. 5, fig. 10) the same effects may be observed with even longer effluves. With the fitting shown in fig. 11 it is even possible, in addition, to give the patient an electric bath, and when the resistance is well regulated the patient can be observed, in the dark, giving off effluves into the air as with the static machine. If, as in fig. 11, the operator uses a brush, an effluve of 30 to 35 centimetres length can be obtained, and one seems to be working with a static machine of a power hitherto unknown. We reckon that 125 to 150 plates would be required if the effluve of the static machine is to be of the same quantity as with this machine.

When the regulation is quite perfect, the field produced by the patient is such that it works by induction at a great distance on Geissler tubes and illuminates them so that when a patient is surrounded by Geissler tubes of the appropriate (correct) length, it is possible to subject him at one and the same time to baths of high

frequency and to a bath of cold light (the light supplied by the Geissler tubes in the electric field which surrounds the patient).

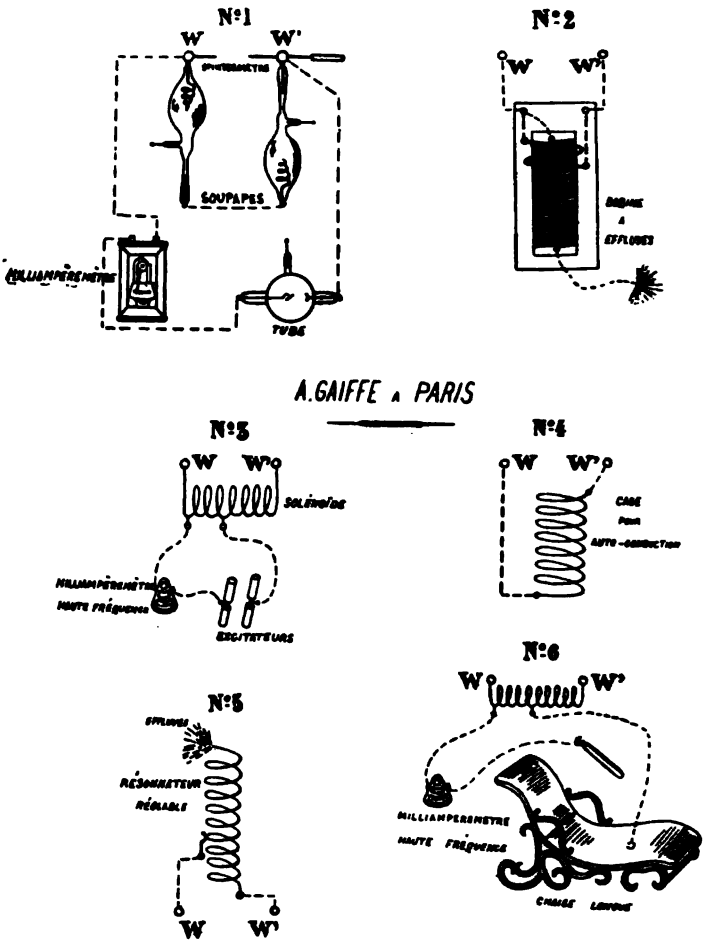


Schéma des connexions de 6 Utilisations indépendantes

Fig. 7.

These effects can, however, only be obtained when the resonator is well regulated. For this a special apparatus has been construc-

ted, the relative size of which is shown on fig. 11. This apparatus, a walnut-wood case on which is rolled a stiff brass wire, is very easily regulated by a contact-lever which runs along an insulator

Fig. 8.

and which can be shifted by means of a handle, working on an insulating pinion which is geared to the coil. The contact between the solenoid and the lever is carried out by a spring which receives one of the wires W^1 which comes from the case, the other is connected to the terminal W.

X-Rays.

The power at disposal with this apparatus is more than sufficient for all uses with X-rays, whether using as source an alternating current or a constant current changed into an alternating current by a commutator.

The chief advantage which Gaiffe's installation has, is that it is as powerful as is wanted for all radiographic uses, if in addition one considers that the use of interrupters is avoided, this alone would justify its use.

No. 1 of fig. 10 shows two Villard valve tubes, which are connected to the terminals in parallel to the tube, so as to allow the waves in one direction to pass through the tube—the cathode of the X-ray tube being connected to the same terminal as the anti-cathode of the valve tube. In the circuit of the X-ray tube is placed the milliampèremeter specially constructed by M. Gaiffe for this purpose.

In working with this installation, the transformer, the resistances in gear, and the capacities once for all determined and working the machine on a circuit of alternating current of fixed frequency, one can be sure that to a certain difference of potential in the primary of the transformer will correspond in the secondary a difference of potential easy to calculate and equal to that read for the primary, multiplied by the product of the number of turns of the two windings. The capacities being fixed, the current circulating in the tube, and measured with the special milliampèremeter, can only vary if the state of the tube itself varies.

We will now close the primary current, and regulate it with the resistance. We shall see, starting with a certain value of difference from the potential to the primary, the tube illuminating and getting greater brilliancy with the greater voltage. At the same time the milliampèremeter, which had remained at zero whilst the tube was dark, will deviate, and its deviation will increase with the brilliancy of the tube.

The same tube, at a different vacuum, greater than that of the first experiment, will commence illuminating at a higher voltage to that previously found; it will increase in brilliancy with the difference of potential, will also assume an increasing intensity to a less extent, however, to that of the first experiment with the same difference of potential.

This is a sure confirmation that, for a known difference of potential, the intensity circulating in a tube depends on the vacuum of the tube.

What conclusions can, therefore, *à priori* be drawn, reserving the exact verification till later?

1. That for a tube of a given vacuum, the same difference of potential must always create a current of the same intensity.

2. That for a same difference of potential a tube that is harder and consequently more penetrating the current circulating in it is weaker.

The first of these conclusions has been verified in many ways, and its consequences are great.

It does, in fact, result therefrom that:

As long as a regulated vacuum tube is kept at the same intensity under the same difference of potential the tube remains in the same state, and consequently emits the same quantity and the same quality of X-rays. Or, in other words, it is possible to *keep* a regulated vacuum tube (? given vacuum tube) in the same state *indefinitely* if it is constantly made to work at a constant difference of potential and intensity, which can be done by acting solely on the vacuum regulator.

Each time that a tube is replaced, even after a long interval of time, to work at the same intensity and at the same difference of potential, it emits the same quantity and the same quality of X-rays.*

This result can be easily shown, as is proved by the four radiographs of the Benoist radiochromometer placed at the top of fig. 12. These four radiographs have been made with the same tube (Chabaud-Villard tube with an osmo-regulator), the same difference of potential and the same intensity, the same (exposure) to each plate, in order to avoid the errors of developing and the sensitiveness of the emulsion. Between each radiograph the tube has done much service, and its degree of vacuum has been greatly modified and then replaced to the degree wished for at the moment of use. A careful study of the plate will clearly prove that the quality of the rays was the same, since the radiochromometer could be crossed in the same manner, and that the quantity of the rays was the same, since the radiographs are of the same intensity.

The second statement is not difficult to prove: a simple radioscopic examination of the Benoist radiochromometer proves its exactness.

These two proved propositions lead to a remarkable result.

From the moment when, by a same difference of potential and a same intensity, one constantly has (with the same tube) the same quality of rays, when the rays emitted are as much more penetrating as for a difference of potential the intensity is weaker, it should be possible, taking a base agreed to by all the world, as, for instance, Benoist's radiochromometer, to draw up tables from which one can simply read the degree of penetration of a tube at work of electric constants.

This can be absolutely carried out. These tables must be drawn up for each separate tube, although recent experiences, of which we shall speak later, allow us to affirm with an almost exact accuracy that, given the equal transparency of the glass, tubes of a different make, but of the same kind of anti-cathode, give the same results when the electric constants are the same.†

---

*In these data no notice has been taken of outward agencies which might falsify the results, such as any modification in the state of the surface of the glass of the tube, any modification in the transparency of the glass, etc. These modifications, however, appear to be of little importance and not to exercise any noteworthy effect, except when the tube becomes too unstable to be used.

†We beg our readers to remember that the electric constants in question can only serve for comparison if they belong to a same installation working on an alternating current of fixed frequency.

One can even draw a very important conclusion from this table. For the same degree of penetration the quantities of X-rays emitted are sensibly proportionate to the intensities.

It is these radiographic negatives which have allowed us to establish these data.

The third series of negatives of fig. 12 represents three radiographs made on the same plate at the same time by three Chabaud-Villard tubes; one large pattern, one small pattern, and one anti-cathode conic tube working with the same electric constants. The three plates are alike as to intensity and degree of penetration, proving the same quality and the same quantity of X-rays.

The fourth series of negatives of fig. 12 shows radiographs made under the same conditions with a Chabaud tube and a tube of German origin; there again the same conclusions may be applied.

Lastly, the second series of negatives represents three radiographs made with a tube kept as much as possible at the same degree of vacuum and working at different constants during such times in which the product $I \times i$ is equal to one constant. There, also, the radiographs appear to bear out our conclusion, but this last experiment is of such delicacy that we reserve our opinion.

To sum up: the introduction of a milliampèremeter in the circuit of the X-ray tube, under the conditions above specified,* has enabled M. Gaiffe to obtain the following very important results:

1. That it is possible to keep a tube in the same state of working for as long a period of time as is necessary;

2. That it is possible, even after a considerable lapse of time, to bring back a tube into giving the same quality and the same quantity of X-rays;

3. That it is possible to draw up a table giving, for each installation of electric constants, the quality of penetration of X-rays determined, for instance, by means of Benoist's radiochromometer.

4. It seems certain that all tubes from the moment that their anti-cathode is of the same metal or that their cathodic bundle is well centred, yield the same quality and the same quantity of X-rays when the electric constants are the same.

5. It is probable that the quantity of X-rays emitted by a tube at the same degree of vacuum is in proportion to the intensity of current circulating in it.

6. That, if instead of the arrangement in No. 1 of fig. 10, which separates the two alternating waves in order to allow only a wave

*The introduction of a milliampèremeter in the circuit of a tube worked by a coil or a static machine will certainly give an indication, which, added to the degree of penetration, as read from the radiochromometer, will be of a certain value; but the modifications of the intensity, instead of being simply due to a variation in the state of vacuum of the tube, can arise from variations in the interrupter (change of speed or regulation) or variations of the static machine, and consequently the milliampèremeter in this case does not do away with the constant use of the radiochromometer, which only gives the needed information at the very moment of reading from it.

which runs always of the same direction to pass into the tube, we make a mounting in which two circuits in derivation are constituted by a tube and a valve tube respectively, we shall obtain two tubes working together on the same installation. If we cast radioscopes from these tubes upon a screen we shall get two images which we can separate by a synchronic shutter, letting each eye see only one image always given by the same tube.

This is the process which M. Villard* indicates as adapted for stereoscopic radioscopy, and we believe it to be the only practical one.

Without further insisting on the importance of these results we will only remark that this new installation of Messrs. Gaiffe is the only one with which doctors can study the action of the X-rays in a scientific manner, either for radiography or for radiotherapy, and the only one which will allow of their recording the results obtained in a way which can be universally understood.—*Archives d'Electricité Médicale*, July 25th, 1904.

CURRENTS OF HIGH FREQUENCY AND HIGH POTENTIAL.

These currents find their chief field in the treatment of those cases of gastric neurasthenia attended with defective metabolism. We thus find them of great use in the neurasthenia of gout, and in cases where the patient takes too little exercise. As the result of my own experience I find that the most efficacious method of applying them is a combination of auto-condensation with the current taken from the top of the resonator. The patient lies upon the condensation couch which is connected up by derivation to the two ends of the small solenoid in the usual manner. A moistened electrode attached to the top of the resonator is applied to the epigastrium and kept in position by the hand of the patient or, better still, by a bag of shot. We thus, at the same time that the patient is undergoing auto-condensation, are acting locally upon the stomach by the current of higher potential from the resonator. A daily application of ten minutes should by given, at first every day for two or three weeks, after that, three times a week for a month or so. The total quantity of urine passed in the twenty-four hours, with the per cent. of urea and uric acid should be carefully estimated at least once a week during the duration of the treatment.

*Villard, "The Stereoradiscope by Alternating Currents," *Archives d'Electricité Médicale*, April 15th, 1901, p. 205.

X-RAYS IN THE DIAGNOSIS OF JOINT CONDITIONS.

By Edward W. H. Shenton, M.R.C.S. Eng., L.R.C.P. Lond.

(Continued from p. 284.)

To apply the following diagnostic lines to the elbow joint it is necessary to obtain by screen or radiograph an image of the bones taken according to a fixed but simple rule.

This rule provides that the arm and forearm shall be viewed in a directly lateral position, the hand being midway between supination and pronation (*i.e.*, with the thumb pointing anatomically upwards).

The antero-posterior view being usually an impossible

Fig. 1.—Lateral view of elbow taken in correct position to show the lines which are of diagnostic value.

one in any elbow injury owing to the degree of flexion generally present, no attempt has been made to apply diagnostic lines.

The tube has to be so arranged that a purely side-to-side view of the lower end of the humerus is seen and a clear interval indicating the elbow joint. The operator may obtain this view in several ways, but the one I believe to be best is obtained as follows :—

Let the patient sit sideways at the table allowing the injured elbow to rest upon the canvas top, the tube being below and the screen above.

It is impossible to say exactly the point under which the anode of the tube must be placed to obtain the correct view, adjustment of the tube during examination is the only way to successfully and quickly attain this end.

At this stage it will be as well to consider the natural lines which are to serve as land marks to the operator and which are always visible in this particular position.

The outline of the humerus is much like that depicted in anatomy books and need not therefore be dwelt upon. Its anterior edge, however, will be of interest later. But dark, well-defined lines in the interior of this bone are quite uncommon and belong solely to radiographic anatomy.

At the lower end of the humerus an almost complete circle is observable, formed by the foreshortening of the joint surfaces of the humerus, great density to the rays being thereby formed.

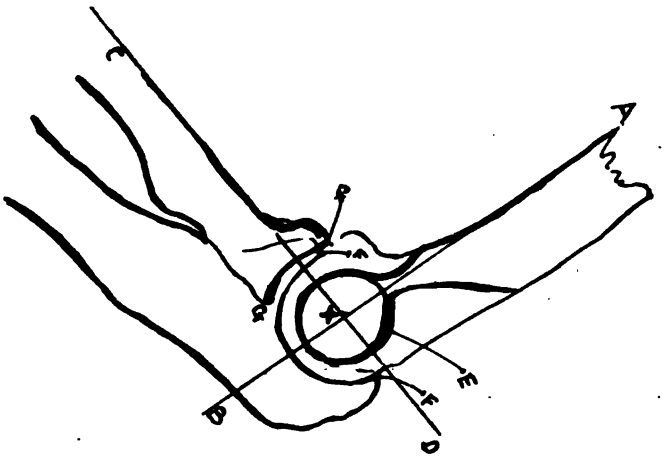


Fig. 2 explains the position of the important natural lines of Fig. 1, and shows the application of the diagnostic lines.
AB—Anterior-humeral line.
CD—Anterior-radial line.
X—Centre of small circle *E*.
FF—Ulna joint surface line.
GG—Radius joint surface line.

At the upper part of this circle the two ends of the broken circumference turn away, forming roughly an angle of 45°, each, continuing in its particular direction until it merges into the outline of the shaft. These two lines indicate the positions of olecromon and coronoid fossæ.

The joint surfaces of the ulna and radius are seen in profile and all these, together with the anterior outline of the radius, concern the purpose in hand.

If with a pair of dividers the operator finds the centre of the small circle he will also find that the outlines of the ulna joint surface and the depression in the head of the radius are each part of a circle concentric with the small humeral circle.

If he lay a straight edge along the anterior margins of the humerus and radius (of which the halves nearer the elbow will probably only be visible) he will observe that both these lines nearly reach the centre of the circle, in reality meeting at a point a little behind the centre.

To practically apply these lines in the diagnosis of injury to the bones forming the elbow joint it will be found unnecessary to use dividers and straight edges in most cases. Take for an example a suspected fracture of the lower end of the humerus. These are peculiarly deceptive, and many will give no evidence of their presence at first glance. Bearing in mind, however, the continuation of the anterior humeral line and the centre of the circle, it will at once be apparent that some displacement is present, as these do not coincide, the line falling almost invariably in front of the circle's centre, instead of right on or behind. On the other hand, the anterior radial line falls normally, and the remaining joint lines are concentric, clearly indicating that though there is displacement at the elbow it is the whole joint that has been displaced, its component parts being in correct relation to one another, and real dislocation is present.

In dislocation of both bones of the forearm conversely, the want of concentricity is apparent while the anterior humeral line is intact, but the radial falls abnormally.

It is not necessary to detail further applications of these lines, for so many will suggest themselves to the reader, but I would urge, in conclusion, that great care be expended to obtain a good skiagram of this joint in as perfectly a lateral position as it is possible, the rest will then be easy.

(To be continued.)

In future the Journal will be published on the 15th of each month, so that communications made to the Society may be inserted in the issue of the subsequent month. The Editor regrets that this month's has been delayed owing to unforeseen circumstances.

ON THE METHODS OF APPLICATION OF HIGH FREQUENCY CURRENTS.

By Clarence A. Wright, F.R.C.S. (Ed.), &c.

(Continued from p. 355.)

Auto-Conduction.

Perhaps the most remarkable and therapeutically interesting of the physical properties of high frequency currents are their capacity for producing very powerful inductional effects. Although these are to some extent exemplified in treatment by condensation, still it is in auto-conduction that they find their best illustration ; for whilst in treatment by the former method the therapeutical efficacy of the charges engendered by electrostatic induction is undoubtedly turned to account, it is by the latter alone that advantage can be taken of the full intensity of the electro-magnetic field created by induction. In auto-conduction, as in condensation, a distinction can be drawn between general and local methods of application.

General Auto-Conduction.—It is almost universally admitted that d'Arsonval can fairly claim to have originated this mode of vibratory electrisation, although the discovery of the adaptability of a grand solenoid to therapeutical uses* cannot be placed to his credit. Before proceeding to discuss the points of distinction and difference between the methods of simple auto-conduction as defined by d'Arsonval and the more elaborate procedures devised by Apostoli and others, a description must be given of the apparatus employed in treatment by these methods.

The Solenoid of Auto-Conduction.—The grand solenoid or cage of auto-conduction, as it is sometimes called, is a cylindrical helix 7 feet long by 36 to 48 inches in diameter, formed of 8 to 30 turns of stout copper ribbon, tubing or wire. The spirals are maintained in position by suitable insulating supports—either cords and tapes of specially prepared silk or flax, or by pillars and bars of well varnished or paraffinated wood. As the solenoid is intended for the reception of the body of the patient, it must be sufficiently large and spacious not only to accommodate it, but also to allow of easy ingress and egress. Those of the dimensions above mentioned have been found to well serve this purpose. The two chief types of solenoid in general use are the one intended for use in the vertical, the other in the horizontal position. As regards construction, it may be noticed that the

* The investigations of Lipman show that d'Odiardi's claims to have originated "*Treatment by Enclosure of Patients in a Solenoid*" cannot be substantiated, as others had long previously employed it for a like purpose.

arrangement of the spirals and their number vary in apparatus of different makers. In some forms of the large upright solenoid the spirals are copper bands permanently attached to the wooden framework of the cage, a door being provided to admit the patient: in others, the wire coils, which are suspended by silken tapes or cords, can be drawn up like a Venetian blind by means of an arrangement of pullies. The break in the continuity of the spirals in the first case gives rise to a certain amount of spark and interruption in the flow of the current. It is for this reason not so frequently employed as the other, which when not in actual use can be drawn up so as to leave more space at the disposal of the operator. In the horizontal model the wires are either permanently fixed about the insulating couch or else arranged so as to allow of their being drawn into position after the patient has been placed upon the couch. Both the vertical and horizontal types of solenoid are available for use in treatment by Apostoli's method; still the latter is to be preferred in dealing with the hypersensitive, the infirm and bedridden. It must, however, be remembered that whatsoever may be the type of solenoid employed, its terminals have to be connected with a source of currents of high frequency, so as to form a completely closed circuit. This is done either by connecting them with the opposite poles of the small solenoid of a high frequency machine, with the free terminals of a duplex or of a double resonator tuned to produce interpolar effects, or even directly with the external armatures of the condensers. Besides these essentials it is usual to provide the vertical cage with an insulating platform and an induction ring, with pilot lamp or Geissler tube to serve as an indicator.

Simple Auto-Conduction.—This is the method originally described by d'Arsonval, under the name of Auto-Conduction. It consists in placing the patient on the insulating platform or couch in the interior of the solenoid traversed by the oscillatory currents, ***without any direct contact with its spirals.*** Owing to the intensity of the electro-magnetic field, the body of the patient becomes the seat of powerful induced currents, which play over its surface and penetrate to some extent into its substance. Although there is no known device whereby the intensity of the current so induced can be directly gauged, still an approximate notion can be formed by noticing the effects of the inducing currents on the pilot lamp or tube which serves as an indicator. The presence of the induced current can, however, be experimentally demonstrated in the following manner:—

If a neutral capacity—say the hand of the operator—be introduced between the wires of the cage without touching them and brought in relation with the body of the patient, a shower of fine sparks can in the dark be seen passing

between them. A subjective sensation of prickly warmth in the parts so approached is at the same time experienced by both operator and patient, but more so by the former: for the discharges which irradiate from an actively electrified capacity are less painful in their effects than those which impinge upon a neutral capacity which receives the discharge from an active source.* It may equally well be demonstrated by causing the patient, whilst observing the same precaution, to extend his hand through the bars of the cage towards a passive body placed outside the solenoid. This experiment of Baedeker's is always suceessful, and is a direct proof of the existence of an induced vibratory current upon the surface of the body. D'Arsonval claimed that if the subject of the experiment should hold the wire terminal of an electric lamp, so as to form a loop-circuit, the lamp would be brought to incandescence by the intensity of the current traversing it. Eulenburg and others have essayed this experiment and proved it a failure. Reus suggests as an alternative experiment the following:—"When the terminals of the lamp (which is placed outside the cage) are of unequal length and connected with manettes held by the patient, the current induced in the lamp-filaments can be demonstrated by the operator holding on to the glass globe. This is always a safe platform experiment." Again, if an induction ring be placed outside the cage with its terminal knobs sufficiently far apart to prevent sparking, and the hand of the person enclosed in the cage be applied to one terminal, a succession of bright sparks is noticed, owing to the resonance-equilibrium of the arms of this rough induction balance being upset by the added capacity.

Adjugate Auto-Conduction.—The complex methods of vibratory electrisation, introduced into practice by Apostoli and Berlioz, have been extended. In treatment by Adjugate Auto-Conduction, the patient is placed in the cage and connected with at least one pole of the solenoid of auto-conduction. The combinations by which such treatment can be carried out are four in number:—

(*a*) *Auto-Conduction with Monopolar Derivation.*—Here the patient placed on the insulating couch is in unipolar derivation on the circuit formed by the solenoid and its connections to the condensers. This is known also as "the first method of single contact."

(*b*) *Auto-Conduction with Bipolar Derivation.*—This is the method of "double contact," the patient being connected by means of suitable electrodes with opposite poles of the solenoid of auto-conduction.

* *Cf.*, the relative effects of eductive and receptive effluvation.

(*c*) *Auto-Conduction with Bipolar Condensation.*—The patient is here attached to one pole of the solenoid of auto-conduction, the other pole being connected with the metallic sheet of the couch-condenser, on which he is placed. This is "the second method of single contact."

(*d*) *Auto-Conduction with Simple Inductive Condensation.*—It occupies an intermediate position between simple auto-conduction and the methods of auto-conduction with contact, above described. The metallic sheet of the enclosed couch-condenser is alone connected with the solenoid, the patient upon it being entirely free from any actual connection with the wires of the cage.

REACTION.—Although the presence of the induced currents is incapable of direct physiological demonstration (for they have no appreciable influence on tactile sensibility and neuromuscular contraction), still it must not for an instant be supposed that treatment by these methods are without effects upon the system. The accumulated evidence of extended clinical observation proves the contrary. The researches of Apostoli and of others show that the reaction of all patients to this mode of treatment is not always the same, for much depends on: (*a*) the nervous susceptibility or idiosyncrasy of the patient; (*b*) the nature of the malady from which he is suffering; (*c*) the duration of the session; and, lastly (*d*), upon the technique.

(*a*) *Individual Susceptibility.*—It is within the experience of all observers that whilst some patients appear to be unaffected by this method of vibratory electrisation, there are others upon whom the impression made is extremely disagreeable, if not absolutely alarming. Between these two extremes every grade of difference is to be met with. In a few the nervous system does not seem to be at all affected by the most prolonged session, even when administered for the first time or after a long period of intermission. These are cases of individual insusceptibility and are to be distinguished from those in which the "habit of auto-conduction" is acquired by long-continued treatment. Unfortunately this personal immunity to the bye-effects of auto-conduction is but rarely met with. The majority of patients, without experiencing any well-defined sensations during the application, do certainly manifest some degree of lassitude after its termination. This usually lasts for about half-an-hour when it gradually disappears. A class of patients, scarcely less numerous, are those who during the session—more especially towards its termination—experience a feeling of prickly warmth about the head and face. When the pilot lamp is fixed inside the cage just over the head of the patient, these ofttimes refer the sensation to this cause. In these the feeling of lassitude, sequent to an application, is generally

as marked and prolonged as in those first referred to, although some among them manifest no symptoms in the interval between the sessions. More limited is the number of those in whom the subjective sensation of local heat gives place to a headache—partly nervous, partly congestive—which comes on towards the end of the sitting and lasts for 10 to 40 minutes after. There is still another class of subjects who develop a neuralgic hemicrania about half-an-hour after the session. This lasts for four to six hours. In some cases the suffering is more prolonged, and Reus mentions three cases in which facial neuralgia in a severe form appeared during treatment, and continued unabated for three, four, and six days respectively, utterly prostrating the patients. Along with the headache, some patients complain of dizziness and a swimming sensation in the head, blurred vision, and a difficulty in co-ordinating their movements—"Feel as if I were drunk," being the expression which many use to describe their sensations. In these, some degree of subsequent lassitude, malaise, and prostration is to be expected. There are others who manifest no symptoms whilst in the cage, but who suffer from a lassitude, nervous distress, and general sense of misery so marked after its termination as to render this mode of treatment absolutely intolerable. From the preponderance of nerve symptoms it may rightly be inferred that the class most liable to be affected are persons with a high-strung nervous system, whose bodies are surcharged with toxic product, the result of auto-infection or defective elimination.

(*b*) *The Nature of the Disease.*—Apart from patients, the subjects of cardiac disease for whom this mode of treatment is unsuitable, is a large class of cases, in which the nervous system has been greatly undermined by the toxic products of auto-infection, perverted metabolism, and defective elimination. A surfeit of long store-up waste products suddenly discharged into the blood by a session of auto-conduction, and the active determination of blood to the head are the two factors which render sufferers from azotic waste products liable to develop nervous symptoms during treatment, more particularly when their eliminatory organs have already been overtaxed by the increased demands made upon them. In addition to these, we find sufferers from debility, the result of auto-intoxication, forming a distinct class who react badly. These chiefly suffer from senile rheumatism, rheumatic gout, some forms of diabetes, anæmia, and chlorosis—the last two as the result of absorption of toxic products from the digestive tract. It is in nowise strange, when the pathology of these diseases is considered, to find that patients, otherwise intolerant, or who develop untoward symptoms, can by a course of mineral water, used

in conjunction with auto-conduction, be brought not only to tolerate auto-conduction, but even to benefit therefrom; as the free lavage of the digestive tract and flushing of the eliminatory channels by the absorbed fluid largely favours the elimination of the toxic products upon which their ill-health depends. It may be objected that the supplementing of auto-conduction by such well-known remedial measures must interfere with exact knowledge of the value of auto-conduction in these cases. This line of argument, however, appeals more to the ignorant than to those already acquainted with the physiological effects of this method of treatment. To promote metabolism and render the effete matter circulating in the system better fitted for elimination is the *forte* of auto-conduction; its influence upon the actual elimination of such waste products is not manifest to the same extent: consequently, all measure that tend to help forward the latter can in nowise detract from the therapeutic utility of auto-conduction as a remedial procedure in these diseases. As already mentioned, patients of this class are prone to manifest symptoms of intolerance in the cage, and some degree of fatigue and weariness after their exit therefrom. This is naturally more marked during the earlier sessions, becoming less evident as treatment proceeds. The anæmic who have previously suffered from neuralgia are often troubled by its recurrence, and require much encouragement to persevere with treatment. So, likewise, has it been found that patients suffering from malaria and syphilitic cachexia experience a recrudence of symptoms when first subjected to treatment, although they eventually benefit greatly. Women at the menstrual epoch are also very susceptible.

(*c*) *The Duration of Sessions.*—This has an important influence upon the nervous susceptibility of patients. Although some are naturally immune to any nervous manifestation proceeding from a preliminary session of long duration, still their numbers are so limited that, as a precautionary measure, it is considered advisable in all cases to limit the duration of the first few sessions so as to watch their effects upon the patient. Some patients manifest slight symptoms of intolerance during the first few sessions, but these wear off as treatment proceeds and give place to a regular habit of auto-conduction. Others manifest no symptoms during the earlier sessions, but these appear when the duration is increased. Some manifest a recurrence of untoward symptoms with every increase in the length of a session; others more tolerant only experience them when the sessions are first extended but do not react to subsequent increases in their duration. In some the limit of tolerance is clearly defined; they stand every increase up to a certain limit—peculiar to each case—and any further increase at once brings

out so alarming an outbreak of intolerance as not only to interfere with immediate treatment but also to limit the benefits to be derived from this mode of electrisation. It is, however, often noticed that one can supplement by frequency of repetition the deficiencies which a limit of duration entails; for patients who manifest symptoms whenever the duration exceeds their safety limits, bear frequent repetition better than the majority of patients. It has been observed that whilst some patients can, after a long interval of rest, resume treatment with a prolonged session, others must start again at the beginning and be gradually advanced, else they react badly. This shows that the habit of auto-conduction is relative and temporary, and nothing like the personal immunity of some to all nervous reactions provoked by sessions of auto-conduction.

(*d*) *Variation of Technique.*—Apostoli and others have proved that the combined methods of auto-conduction are less liable to provoke untoward symptoms than d'Arsonval's mode of treatment. The following is Reus' explanation of this phenomenon :—"The currents induced in the body of the patient by treatment in the case of auto-condensation play more particularly over its surface. This is in keeping with our notion of the laws governing the transmission of alternating currents by conductors. If by means of a conducting wire connected with one pole of the solenoid a passage for the discharges be provided, it is natural to suppose that the amount of energy that finds its way into the interior of the body will thereby be largely limited." The objections that have been raised to this explanation are that the body is an electrolytic conductor and not a metallic one, and may therefore react differently; that it does not account for the case of combined auto-conduction with simple inductive condensation —in which the amount of sensible reaction is similarly limited.

Placed in the order of their minimum sensory reaction, the methods of adjugate auto-conduction are :—

(1.) Auto-conduction with bipolar derivation.
(2.) Auto-conduction with monopolar derivation.
(3.) Auto-conduction with bipolar condensation.
(4.) Auto-conduction with simple inductive condensation.

The order shows that Reus' explanation, albeit imperfect, is largely supported by clinical observation. Extended research has proved that Apostoli is right in his summary of the effects of auto-conduction. The order of advance is as follows: the return of sleep; the improvement in strength and vital energy; increase in animation and powers of application, with an amelioration of fatigue caused by exertion; improvement in appetite and general nutrition leading on to perfect restoration to health.

(*To be concluded.*)

NOTES.

FRANK JUDSON PARKER, "Non-operative Treatment of Trachoma." *Medical Record*, New York, September 17th, 1904.

This paper, which contains an interesting summary of the methods of dealing with this condition, is marked by a notable omission. The X-ray treatment of this condition first described by Mayou certainly deserves to rank among the non-operative methods of treatment.

We have had opportunity of testing Mayou's method, and have found that, although tedious, it leaves little to be desired both as regards certainty and efficiency.

* * *

BORRMAN, *Deutschc Medizinische Wochenschrift*, August 25th, 1904.

This author discusses the spontaneous disappearance of cancers. He considers that there is no evidence that giant cells indicate an attempt at the encapsulation of the cancer cells, a view in which we entirely concur. The exact significance of the giant cell is at present uncertain, but it is present in so many conditions,—encapsulation of foreign bodies, epitheliomata, sarcomata, gummata and tubercle, &c., that it is doubtful whether or no it may have the same significance in each. The point is one which requires further investigation.

* * *

INGALS, *American Laryngological Association*, June, 1904.

Two cases were reported of foreign bodies—pins—in the œsophagus and trachea respectively, which were localised by the X-rays, and then removed through a Killian's œsophagoscope and bronchoscope.

Both were successful. The value of the method was emphasised by several surgeons, who recorded similarly successful cases.

The method can be supplemented with advantage by operating with the aid of the fluorescent screen.

* * *

BORDIER, *Archives d'Électricité Médicale*, September 25th, 1904.

This author reports a case of "Port wine mark" treated by phototherapy. The nævus was situated over the middle of the area supplied by the middle division of the trigeminal, and consisted of two large patches and a number of smaller spots.

The form of apparatus employed was that of Marie, a current of 16 to 18 ampères being used. The author makes a strong point of efficient pressure, which was maintained by elastic bands applied so as to keep the part completely blanched.

The sittings all lasted an hour, and were continued until a marked reaction was obtained. They were then discontinued for about ten days.

Three courses of treatment sufficed in this case to procure complete disappearance of the nævus and all resulting pigmentation.

* * *

ZIMMERN, *Archives d'Électricité Médicale*, September 25th, 1904.

Two types of facial neuralgia are distinguished: moderate and severe: in the former cure is the rule; in the latter, although there may be alleviation in the number and severity of the paroxysms, yet recurrence usually takes place. The sittings lasted one hour, a current of 5 to 15 milliampères being employed.

The author usually employs a large electrode modelled to the face of the patient, the Hemimasque of Bergonié, but he has used, and speaks higly of, a jet of saline solution.

A tumbler is connected with the positive pole, and from this, by syphonage, a jet of the saline solution can be projected over the side of the nasal cavity or along the side of the face. The jet is kept in constant motion during the sitting.

For slighter cases this method brings rapid amelioration and ultimate cure, but for the severer cases, that is to say cases similar to those for which extirpation of the ganglion is performed, improvement is slow and less permanent.

REVIEWS AND NOTICES OF BOOKS.

THE RÖNTGEN RAYS IN THERAPEUTICS AND DIAGNOSIS.

By WILLIAM ALLAN PUSEY, A.M., M.D., and EUGENE WILSON CALDWELL, B.S.

W. B. Saunders & Co. 2nd Edition. Price 21/- net.

The arrangement of this book remains substantially the same. The first part is devoted to the full description of the various types of apparatus employed in the production of X-rays, and of all the accessories. It also gives the methods found most convenient for fluoroscopic and radiographic work, and describes many ingenious devices for obtaining the best results. The system of indexing and storing negatives is one that will recommend itself to those who have charge of hospital departments as a model of neatness and efficiency, and will be found most valuable where reference to old cases is required. The chapter on the choice of an X-ray outfit may be read with advantage by those who are about to take up this branch of study. The second half of the book is devoted entirely to therapeutic work, and is rendered more valuable in that all the previous cases are, as far as possible,

brought up to date; and, on the whole, the results are encouraging. X-ray dermatitis, its causation, course and treatment is fully discussed.

The author gives his own technique fully, and prefers to use an induction coil with a low ampèrage, an interrupter at about 1,000 per second, a moderately low tube, and exposes his patients at a distance of 15 cm., gradually reduced to 5 cm. After the first sitting he gives a week's interval to note, if possible, any idiosyncrasy. He also gives the technique employed by Kienbock, Scholtz, Oudin, and others, and condemns the first of these especially as dangerous. Kienbock holds that idiosyncrasy does not exist, and gives a single sitting of 30 minutes with a moderately soft tube, and awaits reaction. It is a question whether, as we become more proficient in measuring the quantity and quality of the rays, however, whether this method will not prove to be the quickest and most efficacious. He records good results in the treatment of acne and lupus vulgaris, and makes the startling statement, in the chapter on cutaneous carcinoma. that 84 per cent. of epitheliomata treated were much improved or cured. On analysing the cases, however, it appears plain that a very large number from the clinical history and duration are cases of rodent ulcer, which renders it difficult to judge of the success of the treatment of true epitheliomata, which is in the general opinion not very encouraging.

In sarcoma improvement and symptomatic cure in many cases is noted, which bears out the experience of the writer. He urges the prophylactic use of the X-ray after operation in doubtful cases, with which we heartily concur, and suggests it for use before operation where for any cause the operation cannot be carried out. The illustrations and general get-up of the book leave nothing to be desired.

* * *

MANUAL OF PRACTICAL MEDICAL ELECTRICITY.

By DAWSON TURNER, M.D., F.R.C.P. Edin.

Ballière, Tyndal & Cox. 4th Edition. 10s. 6d. nett.

The main alteration in this well-known book consists in the rearrangement of the last part, with the addition of sections on the therapeutic action of radium, and more space is devoted to the physical and physiological actions and therapeutics of the high frequency currents. A description of the properties of radium is given, and the therapeutic indications and methods of application. There are additions to the Finsen literature, and the Finsen-Reyn lamp is discussed. The methods of producing and employing the high frequency currents are described fairly fully, but the author is of opinion that these currents are still on trial. The X-ray section remains substantially the same as in the previous edition. This book affords a useful summary of our present knowledge of electro-therapeutics, and should prove a valuable guide to those commencing the study of the subject.

Dr. W. K. WILLS' MODIFIED FINSEN LAMP.

1

2

3

1.—Lamp with cover removed.
2.—Lamp ready for use.
3.—Lamp in use.

[See Art. pp. 410—413.]

MEDICAL

Electrology and Radiology.

No. 11. NOVEMBER, 1904. VOL. V.

EDITORIAL.

At the Annual Meeting of the British Medical Association at Oxford in July was largely engaged in the discussion on the comparative methods of treating lupus vulgaris and certain other skin diseases.

An interesting discussion was opened by Dr. Sequeira who based his statements on the results of his extensive experience at the London Hospital. He gave a critical survey of the older methods of treatment, the indications for their employment and their limitations, contrasting these with the more modern therapeutic measures.

He considers the Finsen treatment to be undoubtedly the best method for lupus of the skin of the face, the original Finsen lamp and the newer Finsen-Reyn lamp being, in his opinion, the only forms of apparatus which yielded satisfact ory and permanent results. He considered the recent modification of the treatment which consisted of injecting fluorescent substances into the deeper tissues as promising, but requiring further investigation.

He laid great stress on the application of the light to the margins of the affected patch where the tissue was apparently sound. As regards the mucous membranes which he found affected in about 40% of his cases, the Finsen treatment was only possible in a small minority.

In the treatment of the ulcerative form the Finsen treatment is not so applicable, but good results can be obtained by the use of the X-rays, a larger surface being affected at once, but he has not found good results from this method in the non-ulcerative form, nodules persisting after the application of X-rays even when their application has been pushed to the extent of producing dermatitis, and he has further found that in these cases telangiectases are produced and the skin remains susceptible to irritation to such an extent that the ultimate development of epithelioma is by no means a remote possibility.

Radium has not been found to be of marked service while the effleuve of the high frequency discharge has been found to assist merely in the healing of ulcerated surfaces, nodules being practically unaffected by it.

In lupus erythematosus all varieties of treatment have been tried, but recurrence is the rule.

With regard to rodent ulcer his experience has been the while practically, all the cases are amenable to treatment by X-rays, 30% of his cases which were apparently cured have relapsed—the recurrence were in all cases easily removed by repetition of the treatment. In small patches radium was a valuable mode of treatment.

The indication for the various methods of treatment were given as follows :—

For moderate case of lupus of the skin-Finsen ; preceded by X-rays if the surface is ulcerated, preceded by caustics if fungating.

For lupus of mucous membranes—X-rays ; if fungating—cautery followed by X-rays.

For dry areas on the limbs and trunk—excision, if ulcerated X-rays ; for wide dissemination—injection of Wright's tuberculin.

In the subsequent discussion the majority of those who spoke were in accord with Dr. Sequeira as to the method of treatment to employ in given cases and the results obtained thereby. There was a general consensus of opinion that better results might be expected from X-ray treatment in the light of the fact that accurate methods of measuring the quantity and quality of the rays are now available. Dr. Little referred to the successful treatment of ringworm of the scalp in France which is being carried on, and stated that in his opinion the inoculation method of Dr. Wright for sycosis was far superior.

The fact, however, that it is possible by means of accurate dosage which is now practicable to completely epilate in one sitting without danger, renders it probable that the X-rays may ultimately prove the best method of treatment for all diseases of the hair itself.

Dr. Malcolm Morris, in a recent address, based on his experience of over 1,000 cases, lays stress on the frequent recurrence of lupus after every kind of treatment. He advocates the use of the Finsen light, either alone or in conjunction with the X-rays, as the most satisfactory method, both in regard to permanency and cosmetic results for patches of moderate extent on the face ; and for extensive and severe cases where the health is affected, urges also general measures as used in the treatment of pulmonary tuberculosis in addition. The papers in this number by Dr. Wills and Dr. Jacob giving their technique and results will be of interest in connection with this subject.

THE TREATMENT OF LUPUS BY X-RAYS AND THE FINSEN LAMP.

By F. H. JACOB, M.D.

I have been treating lupus by these means for three years, and have during that time had under my care 90 cases. The following paper is based solely upon my personal experience, gained in the treatment of those cases.

During the first half of this period, accessory treatment was but little used; latterly, in addition to the X-rays and Finsen light, some form of accessory treatment has in most cases been employed.

By accessory treatment a large amount of the gross visible lupus can be readily removed in a few weeks, whereas by unaided phototherapy its removal would have taken months; inasmuch then as the accessory treatment is most advantageously employed at the commencement of our attack upon the disease it is best discussed first.

Two methods in particular have proved useful: one by means of pure carbolic acid, the other by pyrogallic acid. The treatment by pure liquified phenol has been used chiefly in cases of discrete nodular lupus and has proved of great value. It is used as follows: a small drop of pure phenol is placed on the centre of the nodule and allowed to remain there until the surface is anæsthetised, by means of a pointed wooden match another drop is now introduced into the centre of the nodule; this is readily allowed by the soft structure of the nodule. As soon as the deeper part is also anæsthetic the match is again introduced and the whole nodule destroyed; finally the carbolic acid is thoroughly well rubbed into every crevice and burrow that can be found. If plenty of patience be exercised the whole process can be thoroughly carried out at the cost of very little pain.

This method is, moreover, a very instructive one for the operator, he will learn how small a fraction of the whole nodule appears on the surface, and will be astonished at the depth and at the distance under the skin to which most ordinary sized nodules will extend; consequently, he will be no longer surprised at the frequency of recurrence, and will be more than ever concerned to make his treatment as thorough as possible. Immediately the treatment of an area about one inch in diameter has been completed, the Finsen lamp (London Hospital model) is applied, the lupus nodules are still quite white from the action of the carbolic acid and allow the rays to penetrate with ease to their deepest recesses. Subsequent healing is rapid and in a week or less the surface is perfectly healed. Unfortunately, the time available for the treatment of hospital patients does not allow of its being carried out in their case. It is, in my experience, the most rapid method of dealing with nodular cases, and gives excellent results both as regards permanence and cosmetic effect. Treatment by pyrogallic acid has been used chiefly for plaques of moderate size, and for the margins of those plaques of whatever size whose centres have undergone atrophy. It is employed either as an ointment or a plaster, usually

containing 20 grains to the ounce. With it instructions are given that, as soon as the pain seriously disturbs the night's rest, the pyrogallic acid is to be replaced by a boric acid ointment.

Cases in which accessory treatment by pyrogallic acid have not been employed, are those in which the plaque is of so large a size that I have dreaded to inflict the pain which would be caused by its employment over so large an area. In others the nature of the patient's work or other personal reason has prevented its use; and lastly, in some very delicate persons, it has appeared unwise to inflict any pain not absolutely necessary.

These various chemical reagents will in most cases remove the greater part of the gross visible lupus; yet, in but few cases will they remove those minute outlying nodules, many of which are probably microscopic in size, and are embedded in sound tissues, but which, by their gradual growth, will soon become only too obvious, and then will have already started fresh microscopic satellites. These minute outlying nodules can be destroyed by chemical reagents of a totally different order, viz., the X-rays and Finsen light. These ether vibrations, which are capable of inducing chemical action, can be made to penetrate the sound tissues without inflicting on them any serious damage, while they gradually destroy the lupus nodules. In this ability to destroy minute unseen nodules embedded in sound tissues, consists their great value. Inasmuch as both these forms of ether vibration are able to do this work for us, it becomes necessary to consider their relative advantages and disadvantages, that we may know in which cases to either or both. Let us take first the X-rays as being the most powerful. Their great advantage is the large area can be treated in a comparatively short time. As an instance, I would give the case of one of my hospital patients, the whole of her face except the forehead, her whole arm from within two inches of the shoulder to the tips of the fingers, and her leg from the knee to the toes were universally affected: her treatment consisted of exposure to the rays twice a week each for the face, arm, and leg, each exposure was of 15 minutes' duration. Now at the end of nearly 2½ years I am unable to find one undoubted nodule; no accessory treatment was adopted. The scar is a very good one.

Other advantages are its ability to remove the subcutaneous thickening which is apt to occur in the upper lip and in the leg; to remove the very disfiguring verrucose condition which was present in three of my cases, in two on the nose, in the other on the fingers; to very rapidly heal up ulcers, provided the dose be a small one, indeed the minute dose necessary has sometimes astonished me. One other and very important fact is the long duration of its action—the fact that its effect continues for several weeks after a very short course of treatment. As a good illustration of this may be given the case of a patient who came from a distance, and who was only able to come for periods of from two to four days at intervals of a fortnight to three months, and whose frail appearance forbad the use of any accessory treatment. She is now, I believe, cured, after two years' treatment, of a patch of very thick lupus on the right cheek, about 3 by 1½ inches diameter.

Though the advantages of X-rays are great, it has a very serious disadvantage. It sometimes leaves a very ugly red scar, due to multitude of telangiectases. Can anything be done to avoid this? I believe that by using small doses, or large doses at long intervals, it can be reduced to such small proportions as to be unobjectionable, and that by finishing up with the Finsen lamp a still better, indeed most excellent scar can be obtained. My bad results—and I have several—have been those in which the treatment was zealously carried out during mild reactions; and in those in which X-rays have been administered during the inflammation due to pyrogallic acid, to which some X-ray dermatitis has been superadded, it seems almost as if the X-rays had fixed the small vessels in their dilated condition. All those patients who have had smaller doses and at longer intervals have good scars; moreover, the duration of treatment is not very much prolonged, and even it were I should still give up the larger doses.

The advantage of the Finsen lamp is its really beautiful scar, which is worth all the tedium which its slowness causes both to administrator and patient. By the aid of accessory treatment and minimal doses of the X-rays the result is very markedly hastened, with only slight diminution of the beauty of the final result. The type of reaction, which has seemed to me most advantageous, is one in which considerable swelling of the skin is produced without blistering; it is not repeated until the reaction has passed off, usually about four days.

In conclusion, the majority of my recent cases are being treated by accessory treatment, followed by both the X-rays and the Finsen lamp; very extensive cases by X-rays alone.

NEISSER & HALBERSTÄDTER, following up the work of Dreyer, publish a series of experiments on the injection of sensitising solutions into the tissues before exposure to light treatment. The solution giving the best results was one of erythrosin; eosin, yanin, and other drugs were used with indifferent success. Experiments were made on animals (principally guinea-pigs), on themselves, and finally on patients under their care. They found that treated in the ordinary way with the Finsen-Reyn lamp, reaction of the deeper layers of the skin never took place; but when previously "sensitised" infiltration of the deeper layers is easily produced and reaction generally occurs in much less time than when the skin is not sensitised. In animals, by injecting deeply, they have been able to affect muscular tissue and even peritoneum. They have used the method therapeutically in cases of lupus, tubercular glands, and epithelioma with good results.—*Zeitschrift für Elektrotherapie.* October, 1904.

ON THE METHODS OF APPLICATION OF HIGH FREQUENCY CURRENTS.

By Clarence A. Wright, F.R.C.S. (Ed.), &c.

(Continued from p. 399.)

Graduation.—Where the wire terminals of the cage of auto-conduction are connected with the poles of the solenoid of high frequency, the intensity of the current traversing the shunt circuit can be directly controlled by adjustment of the contact regulator; but where they are in direct communication with the condensers of the generator, one has to rely on accessory measures. Reus has experimentally introduced an inner lining of paraffinated paper screens, which, working shutter-like, can produce a variation in the dielectric constant of the medium separating the patient from the wires. The results observed are promising, but can scarcely be said to have as yet passed the experimental stage. The same remarks apply to Hance's attempt to vary the intensity of the currents by altering the position of his inducing solenoid. In practice the operator gauges the effects of the current by noticing the brilliancy of the pilot lamp.

Duration and Frequency of Sessions.—In fixing the duration and frequency of sessions the operator must be guided by the nervous susceptibility of the patient and the reaction caused by the first few sessions. Where he has reason to believe that tolerance is inherent he can rapidly push treatment. In cases that manifest symptoms of intolerance he has to discriminate between (1) cases in which the symptoms are transient and will vanish as treatment proceeds; (2) cases of relative intolerance—the critical duration being carefully observed and avoided; (3) cases of absolute intolerance which are quite unsuitable for treatment. In cases of natural immunity, treatment can be rapidly pushed. In cases of transient intolerance, cautious increase in the duration and frequency is recommended, care being taken not to allow too long an interval between the successive sessions. In those characterised by limited or relative tolerance, it has been observed that, provided the critical duration be not exceeded, no baneful symptoms are provoked, and a rapid repetition of the sessions rather than increase in duration has to be adopted. In cases of absolute intolerance, some other methods of treatment must be resorted to. As each case is a law unto itself, it is no easy matter to gauge the nervous susceptibility of patients. It is usual, therefore, to limit the first few sessions to four or five minutes, and cautiously increase the time of application if the reaction of the patient justifies one in doing so. The following rule may be laid down for the guidance of the operator: "Symptoms of

intolerance coming on during a session bar the way to any immediate increase in the duration of subsequent applications. Those which appear after its termination must guide the operator in determining its frequency—provided always that too long an interval be not allowed to elapse between any two consecutive sessions."

LOCAL AUTO-CONDUCTION.—This is an application of the general principles of auto-conduction to a more or less restricted area. In the majority of cases a single limb or region is all that is introduced into the solenoid, though this limit may be extended to embrace the entire trunk *below the shoulder-girdle.* The apparatus employed is similar in construction but of smaller dimensions than the wire cage of general auto-conduction. It is actioned by connecting the terminal with the opposite poles of the small solenoid of a high frequency apparatus. In *extended local auto-conduction* the patient is placed on an insulating couch, about which the cage of auto-conduction is fixed so as to leave the head and shoulders outside the sphere of direct electro-magnetic influence. In *purely local auto-conduction* the limb is introduced into one of the small solenoids and rests upon the insulating splint condensers in its interior. It can be connected with a pole of the solenoid as in the contact method of Apostoli, or left free as in simple auto-conduction.

Reaction.—Judging from effects, it is evident that *extended local auto-conduction* occupies a position between general auto-conduction on the one hand and purely local auto-conduction on the other. The restriction of the sphere of direct treatment to the parts *below the shoulder-girdle* limits, where it does not exclude, the reaction of intolerance. For not only are cephalic symptoms less often complained of during the session, but the epicycle of malaise, lassitude, and exhaustion attendant thereon is also almost entirely abolished. By local auto-conduction carried out within still smaller limits, the class of intolerants can be whittled down to so small a minimum that no fear of the effects of treatment upon them may be entertained.

Graduation.—The graduation of intensity is directly controlled by regulation of the self induction of the solenoid of high frequency in the generator apparatus and by the selection of suitable cages, so as to limit the area of surface exposed in the electro-magnetic field.

Duration and Frequency of Sessions.—As the risk of arousing the reaction of intolerance is reduced to a minimum, the duration and frequency of the sessions need not cause the operator any anxiety. His judgment will doubtless guide him aright in fixing their length and frequency by using derivation methods as his guide.

Finis.

SOME NOTES FROM THE BRISTOL GENERAL HOSPITAL.

By W. KENNETH WILLS, M.A., M.B. (Cantab.).

Dermatologist to the Bristol General Hospital.

Nearly 150 cases of one disease or another have been, or are still, undergoing treatment in the department set aside for the special treatment of skin diseases by various forms of electrical treatment.

To give any idea statistically of the cases would be quite valueless, especially as far as the lupus cases are concerned; for when we first instituted the Light treatment we inherited the old chronic patients, who, having suffered many things at the hands of many physicians and surgeons, lastly came up for treatment in the electrical room, rather than leave any shrine without an offering.

Not knowing from experience what cases would and what would not be likely to improve under the methods at our disposal, I refused no one, and I think that very few have left without some benefit.

The apparatus at my command comprises two Lortel-Gruond lamps, London Hospital pattern (Marshall & Woods), and two lamps of a pattern of my own, which are the expression of an attempt to amalgamate the principles of the carbon and the iron electrode lamps. A high frequency apparatus and X-ray coil both worked off the constant main with suitable resistance.

The lamp that I have had made is of a very simple pattern, but I have proved again and again that it has some advantages over the carbon lamps I have used.

Two carbon electrodes are hollowed in the centre and a soft-iron knitting needle, which has been notched slightly, is fitted down each of the holes made. The electrodes are fitted to two carriers, which are held by two brass uprights, which are screwed to a bed-plate of insulating porcelain. The whole is covered in by a nickel-plated cap bearing a water chamber with quartz and plates, and tubes for a continual flow of water. The lamp so formed can then be used in two methods: firstly, with a wooden handle for parts difficult of access; and secondly, at the end of a long-arm bracket fixed with a gas-joint to the wall, allowing of up and down and side to side movements. The weight of the lamp is just about sufficient effectually to drive out blood from the skin in moderately supported parts: in very soft parts the weight may not be sufficient and is then increased by a sliding weight fixed to the bracket, which is adjusted by a thumbscrew: in tender parts the weight may prove too great, and in this case it is counterbalanced by a cord leading from a hook in the wall above, and rendered elastic by a loop of rubber inserted in

its course. The current used is from the alternating mains passed through a step-up transformer and used with a condenser.

The light produced is a pale blue one of great intensity, and produces excellent fluorescent effects on Willemite at a much greater distance than iron points alone would do: and I think that the results obtained justify my expectations that they would prove better than either the Marshall & Woods carbon or the Leslie-Miller iron electrode lamps.

On the other hand there are defects in the lamp which are hard to combat. It requires unceasing care in cleansing the inner plate of the water chamber from the iron oxide which rapidly becomes thrown upon it, and it is difficult efficiently to insulate the uprights which serve to carry the current to the electrodes, for the same reason, as the deposit of iron oxide deposited upon the inner side of the chamber serves as a means of short-circuiting the current.

As far as treatment in general is concerned, I am afraid that I cannot speak with any definiteness upon the value of any of the methods employed individually. I have used light, high frequency and X-rays at one time or another upon most of the cases of lupus I have had to deal with. Deficient reaction to the light I meet with an exposure or two to X-rays: ulcerations, hypertrophic conditions, and œdematous areas react in a very ready way as a rule to the X-rays, but there are frequently left nodules, hard to deal with, and unsightly telangiectases. The light may then be applied with benefit frequently, and the high frequency effluve may be used with advantage to improve the appearance of the whole. Diffused erythematous lupus I have found very hard to treat effectually, and some cases have proved themselves very ready to become infected with pus organisms and once or twice with erysipelas.

High frequency treatment I have found of use inside the nose, and I may mention here that a large proportion of my cases of lupus involving the cheeks and nose, on careful enquiry, have proved to have had trouble inside the nose or lachrymal diet before the onset of any external spot. This, according to text-books on the subject, is not apparently the case elsewhere.

With all the treatments I have to report not a few "recurrences," *i.e.*, patients who have not been cured when apparently all the colour has faded, as shown by the diascope.

With regard to rodent ulcer I have always used the X-rays, but here I must report two if not three cases of failure to cure. One case, a superficial rodent involving the scalp over a large area healed in a remarkable way, but in spite of maintained treatment small nodules appear and ulcerate at the margin of the scar. These will disappear on treatment being reapplied, others appearing in other parts of the scar

soon after. Another case of an old and very infirm lady with a rodent of the upper lip and ala of nose started very well under treatment. The part healed, but three small ulcers reappeared, which at present have resisted further application of the rays. Owing to her infirmity she is unable to come regularly for the sittings and this is probably the cause. However, I am inclined to think that there may be such a condition as saturation of the cells with the rays or their effects. Undoubtedly the effect produced by the rays may persist for some time, at first growing in intensity and later fading away. Long after treatment, even when effectual, gently striking the part will produce a local hyperæmia far in excess of that on the normal untreated skin. I have seen it persist for months. This being the case, the disarrangement of the nerve terminals, or whatever the condition produced is, becomes produced after a certain latent period and takes some time to disappear entirely. But if the dose be too great, yet not sufficient to produce "burn," or if the treatment be too long prolonged, it is possible that an indolent condition of the reacting parts is produced, and the further continuance of the sittings be inadvisable, save after a long interval.

Among other cases which have come under my notice, there have been many pathological conditions of the skin, which have called for one of the various forms of electrical treatment other than those mentioned above.

It would be well to mention here a few of the methods which I have used for their relief, and the opinions I have formed as to their value.

One of the cases which I was fortunate in having the opportunity of treating was a well-marked instance of adenoma sebaceum. I tried with X-rays at first and found that nearly all the tumours retrogressed considerably, while the pitted scars of former treatments with cautery, etc., appeared to fill up and became more nearly level with the surrounding skin. After I had given this form of treatment sufficient time, the patient was still left with a number of small tumours which, although considerably shrunken, had not disappeared entirely. These I treated by sparking with a fine glass vacuum electrode used off the resonator of a high frequency apparatus. The immediate result of this application is that in a few seconds a small blister is produced and the pain, which is intense at first, almost ceases on the formation of the vesicle. When one or more of these vesicles is fully formed the patient is left for some days, when a dry crust separates leaving a flat scar, which soon becomes almost of the same hue as normal skin.

As far as I can tell there has been no tendency to further growth on the part of the tumours so treated, and the result is certainly to be preferred to that after the various forms of caustic or cautery formerly used.

I have tried the same with isolated nodules of lupus with very fair temporary results, but, as might be expected, from the nature of lupus to extend beneath the skin more than the eye can detect, the vesicle formed does not always cover the diseased area, and I am also bound to admit it has not always succeeded.

However, this method may be usefully applied in certain instances.

Another method I have used has its basis on the well known property that the high frequency currents possess, in common with other forms of electrical treatment, of dissociating chemical compounds.

When a solution of potassium iodide is painted into the skin and the effluve of the high frequency machine applied to it, the iodine is liberated in a nascent state, and presumably caustic potash produced after the equation :—

$$4\,KI + 2\,H_2O + O_2 = 4\,KHO + 2\,I_2$$

If this is the case we have two effective antiseptic bodies produced in their most active state.

At first I was content to paint the surface with the solution, 1 in 2, of KI in water. Latterly, however, not having obtained the results I desired I have injected a minim or two of a solution 1 in 4 into the nodule with a hypodermic syringe.

High frequency being then applied either with the brush, or fluid-filled glass electrode, the dissociation occurs in the nodule, as is shown by the formation of a brown colour, in a few moments. The results have at present shown favourable results; the treatment is somewhat a painful one, the KI producing a smarting on injection, which gradually lessening may remain for about 12 hours.

I have used this method on certain deep-seated lupus nodules which the light apparatus at my command and the X-rays have failed to eradicate.

I fear that I may be premature in describing this method, but I do so with the hope that the suggestion in other hands and with the same or other chemical solutions may prove an addition to our methods of treating refractory nodules.

NOTES AND ABSTRACTS.

"On the Radiotherapy of Tinea Tonsurans." R. SABOURAUD.

In the January number of the same journal, Sabouraud stated that after the application of a single sitting of X-rays equal to four-and-a-half or five Holzknecht units, there ensues after fifteen days a complete fall of the hair. This fall affects both the healthy and the diseased hairs. The hairs grow again healthy, commencing to do so ten weeks after the fall, growth being complete in another ten weeks. The contagiousness of the place ceases at the end of twenty-five days after the first exposure. This method has been in operation at the Ecole Lailler for six months, and has probably quadrupled the number of cures seen in the previous six months.

The following are some of the statements made by Sabouraud as to the nature and effects of X-rays.

(1). With the static machine, the more penetrating are the rays produced, the greater is the actual amount of rays produced. It is therefore more dangerous to use rays registering on Benoist's radiochromometer 8°-11°, than those registering 3°-5°. In 2,000 sittings Sabouraud had six cases of dermatitis, all due to penetrating rays.

(2). Tubes which with use first begin to show an amethyst colour on the glass through which the rays are emitted. This alters in no way the function of the tube. Later on the tube becomes darkened in a way which he calls smoke (*fumée*). Such tubes cannot be got to work at 3°-4° Benoist, but do so easily at 10°-11°. Such a tube will depilate in eleven minutes as thoroughly as the new one would in twenty-five; if therefore one gives the twenty-five minutes customary with a new tube when using one of these old smoky tubes, one will get dermatitis fifteen days later.

(3). Dermatitis may be divided into four degrees: (*a*) A slightly tender erythema appearing after twelve days and disappearing after six or eight days without leaving any traces; (*b*) An erythema appearing on the tenth day, at first bistre, but turning to wine colour. On the sixteenth to eighteenth day, one can slide off the horny layer from the mucous layer of the epidermis with the finger. This takes about thirty days to recover; (*c*) The inflammation begins on the eighth day with the same symptoms as before, but the whole epidermis is lost, often after the appearance of large blisters leaving a red ulcerating surface behind with much discharge and healing in eight to ten weeks; (*d*) The burn remains atonic and heals after four or five months leaving a

smooth supple scar. Any degree of dermatitis must be avoided in the treatment of ringworm.

(4). Suppose one gives an insufficient exposure on the first occasion, and one finds that fifteen days later some only of the hair falls, a second exposure is dangerous since it will not only bring out the remaining hairs, but will prevent the return of those hairs which were depilated by the first exposure.

(5). It is absolutely necessary to use some instrument for the measurement of the amount of radio-activity used for the case. This was formerly only to be done by the use of Holzknecht's instrument which was expensive to buy, and for which each capsule cost about two shillings. Sabouraud has now brought out a radiochromometer, which is cheap to buy and consists of small pieces of barium platino-cyanide screen, such as is ordinarily used for observing X-rays, and one of these is fixed 8 c.m. from the anti-cathode, while the patient is exposed at a distance of 15 c.m. There is supplied with these discs a coloured standard with which to compare them. Exposure must continue until the exposed disc acquires the colour of the standard. As it resumes its old colour quickly on exposure to light, it is necessary to compare the two rapidly.—*Annales de Dermatologie et de Syphiligraphie.* Tome V., p. 577. July, 1904.

* * *

PROF. MARKWALD (*"Ueber radioaktive Stoffe"*) recapitulates the work of M. & Mme. Curie, Sir William Ramsay, and others. In concluding he describes an experiment by Elster & Geitel to prove the presence of "radium emanation" in the atmosphere. Radio-active substances, it is well known, deposit their emanation on bodies charged to a high negative potential. A long copper wire, suspended in the air, was charged to a high negative potential and left for some time; a charged electroscope was then brought near it, and the leaves converged. The wire was subsequently rubbed with a leathern cloth which was then shown to be radio-active, and remained so for several hours.—*Zeitschrift für Elektrotherapie.* July, 1904.

* * *

A STEAM INTERRUPTER.—An inverted funnel, the tube of which was 7 mm. in diameter and 10 mm. long, was fused on to the lower end of a cylinder 75 mm. in diameter. The vessel thus formed was immersed in a jar filled with a mixture of sulphurie acid and solution of alum. Two aluminium plates were used as electrodes, the one in the cylinder and

the other in the outer jar, and these electrodes were joined up to a battery of 110 volts. On closing the circuit you see a bubble of steam form in the tube of the funnel and escape into the inner cylinder where it is quickly condensed; the circuit is open when the bubble is in the tube and closed when it has escaped into the cylinder. The current can then form a new bubble, which in turn escapes into the cylinder.

This interrupter has the inconvenience of working very slowly, but, on the other hand, it has the advantage of working independently of the amount of metallic circuit and even in the absence of an induction coil or a solenoid, whilst the Wehnelt & Simon interrupter exerts a self-induction which can only vary within very narrow limits.—*C. R. de l'Académie des sciences*, September 5th, 1904.

* * *

BUDINGEN & GEISSLER report the effects of sinusoidal currents applied in the hydro-electric bath in cases of heart disease. They find that sensations of pain and pressure in the cardiac region are relieved, and palpitation disappears whilst appetite and sleep are markedly improved. The effect on the left side of the heart is not very great, but the cavities of the right heart frequently return to their normal dimensions. The heart becomes more regular; intermissions much less frequent and may even disappear; the pulse is increased in frequency and volume. — *Archives d'Électricité Médicale*, October 10th, 1904.

* * *

HAUGHTON & HOLT contribute a paper on "The Frequency of Fracture or Dislocation of One or More of the Proximal Row of Carpal Bones," and quote 10 cases. They note that most text books describe these conditions as being extremely rare, and urge the necessity of careful skiagraphy in all doubtful cases of injury about the wrist joint without obvious loss of normal outline.

The most common injury is fracture of the scaphoid, in eight of the above-mentioned cases this bone being affected. This may be simply fractured across its constricted portion without displacement; the fragments may be displaced or rotated about a longitudinal or transverse axis, or it may be extensively comminuted.

The causation of these injuries are given as (*a*) falls on hand or extended wrist; (*b*) direct violence; (*c*) blow on the knuckle; (*d*) forcible hyperextension of wrist joint; (*e*) traction on rope round joint; (*f*) hyperextension.

To arrive at an accurate diagnosis, it is recommended that stereoscopic skiagrams be taken of both wrists, and that lateral views be also taken as well as postero-anterior, and that similar skiagrams of many normal wrists be studied to observe the differences of the shape of the carpal bones, especially the scaphoid in different individuals.

The anti-cathode should always be placed directly over some definite and constant point.

The treatment of simple fracture without displacement is summed up in two words—massage and movement. Displaced fragments should be removed if reduction be unsuccessful; perfect functional result being generally obtained.

In six of the cases, there was fracture of the scaphoid only; and in three of these, this bone was comminuted. In another case of fracture of the scaphoid, the cuneiform was also fractured and the semilunar and cuneiform dislocated forward. In the eighth case, this fracture was accompanied by a compound fracture of the radius and ulna. Of the remaining two cases, one was a comminuted fracture of the semilunar, and the other a dislocation forward and rotation of the same bone with fracture of the styloid process of the ulna. The writer has had two cases of fracture of the scaphoid, one of which was discovered by skiagram several months after the inquiry, and the second which was complicated by fracture of the proximal end of the second metacarpal, was due to a fall direct on to the head of this bone. The paper is illustrated by three skiagrams.—*Journal of Royal Army Medical Corps*, September, 1904.

PART II.

PROCEEDINGS OF THE BRITISH ELECTROTHERAPEUTIC SOCIETY.

Edited by CHISHOLM WILLIAMS, F.R.C.S., Ed.

OCTOBER 28th, 1904.

The Twenty-fourth Ordinary Meeting was held at 11, Chandos Street, Cavendish Square, W. The President, Dr. LEWIS JONES, occupied the Chair.

Present:—23 members and four visitors.

The minutes of the Twenty-third Meeting were read and duly confirmed. The Town Honorary Secretary read the names, etc., of nine candidates for membership.

The ballot was then taken and proved unanimous in favour of the following gentlemen: — Ed. Canny Ryall, F.R.C.S., 30, Harley Street, W.; Chas. E. Collins, M.R.C.S., East Grinstead; Raoul Marque, M.D., 22, Rue Lacipide, Paris.

The President referred in feeling terms to the death of Dr. Lloyd Roberts, of Chester, who was one of the original members of the Society, and an enthusiastic worker in electrotherapeutics.

Mr. CLARENCE A. WRIGHT then read his paper on "Electrical Methods of Local Medication."

Mr. President and Gentlemen,—A clear conception of the main facts and principles of electro-chemistry is essential to a successful study of local medication by electrical methods; it therefore is concentual with our subject to consider these phenomena and their relations with one another.

It is usual to distinguish two kinds of electrical conduction: the one is *metallic* conduction, in which the flow of the current is unaccompanied by any appreciable motion of ponderable matter or chemical change in the system; the other is *electrolytic* conduction, which, on the contrary, seems characterized and bound up with movement and chemical change. It is the latter, and the phenomena that accompany it, that most concern us at present.

Were we to enquire what substances are conductors in this sense, we should find that at *ordinary* temperatures comparatively few *pure* substances act as electrolytic conductors. To illustrate: F. Kohlrausch estimates that the actual value in reciprocal Siemen's units of the conductivity of chemically pure water is $0{\cdot}36 \times 10^{-11}$ at 18° C. (1) In other words, the

(1) *Wied. Ann.*, liii., 209 (1894).

resistance of 1 millimetre of absolutely pure water at 0° C. (1), is equal to that of 40,000,000 kilometres of copper-wire of the same sectional area—an amount capable of encircling this earth a thousand times. It has likewise been noticed that substances as SO_2, HCN, NH_3, etc., which are capable of forming highly conducting solutions possess in their pure state a conductivity so extremely limited as to be almost negligibly small in comparison with that of the electrolytes that may be dissolved in these media.

The behaviour of pure substances at high temperatures is somewhat different. Fused salts (2), for example, are excellent conductors; and certain metallic oxides in the solid state conduct so well at still higher temperatures that they have, at Nernst's suggestion been employed in the

(1) By taking great care to remove all dissolved bodies, Kohlrausch—*vide Zeitschr. physik. Chem.*, xiv., 317 (1894)—has prepared water whose conductivity, estimated in reciprocal Siemen's units, is as follows :—

Temperature (in Degrees Cent.).	Conductivity (in Mhos.).
0° C.	0.014×10^{-10}
18° C.	0.040×10^{-10}
25° C.	0.058×10^{-10}
34° C.	0.089×10^{-10}
50° C.	0.176×10^{-10}

(2) An idea of the magnitude of the conductivity of fused salts may be gathered from the following table, borrowed from Haber's *Elektrochemie :*

Salt.	Temperature (in Degrees Cent.).	Conductivity (in Mhos.).
$AgNO_3$	272° C.	0·97
	373° C.	1·32
KCl	702° C.	1·20
	800° C.	2·40
NaCl	720° C.	2·87
	780° C.	4·05
$CaCl_2$	710° C.	1·00
	760° C.	1·22
$P6Cl_2$	508° C.	1·56
	730° C.	2·66

The experiments of Poincare, Kramer, Lorenz, and others, show that the conductivity of fused salts and bases increases with the rise of temperature, until it often exceeds that of the best aqueous solutions. Most salts also evince a fair conductivity at temperatures below their melting-point; for the experiments of Graetz have proved that there is no sudden change in conductivity at the melting-point, although the temperature co-efficient of conductivity does here attain to a maximum value. The conductivity of a mixture of fused salts is, in contradistinction to that of aqueous solutions, an *additive* property, being approximately equal to the sum of the conductivities of the component salts.

manufacture of incandescent lamps. In the former (1) group of substances conduction is undoubtedly electrolytic; in the latter (2) very probably so. Although of recent years the manufacture of metals by electrolysis has been greatly developed, still it must be confessed that here practice is ahead of theory; consequently, our knowledge of electrolysis is almost entirely confined to that of the second class of electrolytes, namely, solutions, and more particularly aqueous solutions.

It has already been said that perfectly pure water is scarcely an electrolyte, as its conductivity is almost negligibly small; dry hydrochloric acid is similarly circumstanced. Still, if we mix these two substances together, the resulting solution is an excellent conductor of electricity, and readily undergoes decomposition when electrolyzed. It is evident, therefore, that conductivity is not a property of either constituent, but of the solution that results from their admixture. It must, however, be remembered that every solvent does not acquire conductivity when a substance like HCL is dissolved in it, for neither pure chloroform nor yet a chloroformic solution of hydrochloric acid is an electrolyte in the ordinary sense. It is obvious, then, that the nature of the solvent must play an important part in determining whether the resulting solution will or will not conduct electricity.

Were we asked to assign a cause for this peculiar behaviour of the solvent, we should in all probability refer it to *the medial energy of the substance*—a factor upon which its powers of dielectric separation, tautomerization, and ionization depend, and which finds its simplest expression in the latent heat of evaporation, *i.e.*, in the work required to entirely convert the liquid into a gas. Perhaps we might even, by way of an explanation, go further, and suggest that the unsaturated chemical affinities (like that of oxygen in water, nitrogen in ammonia) do to some extent determine the dissociative powers of the liquid; at the same time safeguarding ourselves against overstrained analogy, by pointing out the fact that "not all such unsaturated compounds dissociate equally well." Again, we might adopt the suggestion of J. J. Thomson and Nernst, and add: There is a connection between the dielectric constant of a liquid solvent and its powers of dissociation, both varying together in the same direction. To illustrate: The dielectric constant of water is 81·12 at 20° C.; of hydrocyanic acid, 95; of methyl alcohol, 32·5; of ethyl alcohol, 25·8; of acetone, 20·7; of glycerine, 16·5

(1) R. Lorenz, *Zeitschr. f. Elektrochemie,* vii., 277-287 (1900), 753-761 (1901).

(2) Nernst, *Zeitschr. f. Elektrochemie,* vi., 41-43 (1899).

or 56·2; of formic acid, 57; of pyridine, 20; of ammonia, 16; of ethyl ether, 4·25; of chloroform, 5·2; of carbon disulphide, 2·6; and the dissociative power of water, as compared with that of these substances, possesses about the same value. Further, if we accept surface tension as the criterion of molecular complexity, and compare the association factor of various solvents with their powers of dissociation, we are immediately struck by the rough parallelism (1) between them. The experiments of Walden and Centnerschwer, which prove that both the dissociative power and surface tension practically vanish at the critical temperature, afford additional proof of the concentual relation that exists between them. It must not, however, be imagined that different solvents react in the same manner to the various groups of electrolytes, for this is not always the case. (2) No explanation can, therefore, be considered as complete that does not take into account the properties of the "solute" as well as those of the solvent.

It may be said that the only substances that in aqueous solution ordinarily exhibit any marked degree of conductivity are acids, bases and salts—the last two also conduct elec-

(1) The following table, prepared by Walden and Centnerschwer, throws further light upon this subject. It is abstracted from *Zeitschr. physik. Chem.*, xxxix., 561:

Solvent Substances.	Dielectric Constant (at 20° C.).	Association Factor (at 20° C.).	Latent Heat of Evaporation.	Ratio of Surface Tension to Molecular Weight.
Water	81·12	3·7	536·2	336·0
Formic acid ...	57·0	3·6	103·7	64·3
Nitromethane ...	56·4	>1·5	127·0 calc.	42·5
Acetonitrile ...	40·0 calc.	1·6	170·7	52·8
Methyl alcohol ...	32·5	3·4	267·0	59·8
Ethyl alcohol ...	26·8	2·7	205·1	38·5
Acetaldehyde ...	21·1	—	136·4	—
Acetone	20·7	1·0	125·3	33·6
Glycerine	16·5 or 56·2	2·92 or 1·8	158·4	—
Ethyl nitrate ...	19·6	1·0	82·0 calc.	23·5
Ammonia	16·2	1·0	329·0	2460·0
Pyridine	20·0 calc.	0·93	101·4	31·0
Piperidine	>20·0	1·06	88·9	24·4
Chloroform ...	5·2	1·0	58·5	18·6
Ether	4·36	1·0	88·4	21·3
Benzene	2·29	1·0	92·9	27·3
Toluene	2·31	1·0	83·6	20·1
Aniline	7·31	1·05	93·3	25·5
Quinoline	8·9	0·81	—	17·2

(2) To illustrate: Acetone shows considerable dissociative powers for salts, like KCl, but hardly any for HCl; whilst in water both these substances are about equally dissociated.

trolytically at high temperatures when fused. An aqueous solution of alcohol, sugar, glycerine, or urea, does not conduct much better than pure water, and can scarcely, therefore, be called an electrolyte. Strictly speaking, the term "electrolyte" has reference only to the conducting solution; still, for syntomy, it is often applied to the dissolved substance or solute. Hence it is that we are accustomed to speak of acids, bases and salts as electrolytes, meaning thereby that their aqueous solutions conduct electricity. Employing the word in this sense, it is ofttimes advantageous to divide solutes into "electrolytes," "hemi-electrolytes" and "anelectrolytes"—the terms "half-electrolytes" and "non-electrolytes" are sometimes used as the respective synonyms of the two last mentioned. The electrolytes include practically all salts, together with the strong acids and bases; the hemi-electrolytes consist of the weak acids and bases; whilst the third group (anelectrolytes) is made up of neutral substances, as sugar, alcohol, urea, etc., which are not salts. There is, however, no sudden break or sharp line of demarcation between these three groups, as intermediate substances are found which cannot be definitely assigned to any particular group. Generally speaking, it may be said that aqueous solutions of the electrolytes are good conductors, those of the hemi-electrolytes poor conductors, whilst those of the anelectrolytes practically do not conduct at all.

Although no simple rule has yet been discovered to express the relation between the chemical constitution of a substance and its conductivity in solution, still, experimental research has brought to light many seeming regularities. Our systemic knowledge of these is almost entirely confined to aqueous solutions as no apparent connection between chemical constitution and conductivity has been established for the other solvents. As the conductivity of a solution is conditioned by the number and velocity of the ions and by the charges which they carry, it were well to inquire what influence the chemical constitution of the solute has upon (*a*) the charge, (*b*) the mobility, and (*c*) the number of ions in solution.

(*a*) *Relation of Charge to Constituton.*—The magnitude of the charge carried depends on the valency of the ion, whether the ion be simple or complex. The sign of the charge depends on the nature of the ion. All the simple metallions, hydrion and certain complex ions as ammonion $NH_4^{\cdot}$ and phosphonion $PH_4^{\cdot}$ carry positive charges. On the other hand, the halogen ions, as chloridion, bromidion, iodidion, along with, hydroxidion OH', and a very large number of complex ions, as sulphanion SO_4'', sulphosion SO_2'', hydrosulphidion HS_3'', carry negative charges. The transition from an anion to a cathion is generally accompanied by too large a change in

constitution to render any comparison between their respective constitutents of much value. Among the compounds of metallic salts with ammonia, in which the change from anion to cathion takes place in stages, the transition through an intermediate anelectrolytic stage can be more readily observed.

(*b*) *Relation of Mobility to Constitution.*—The mobility of elementary ions is a periodic function of the atomic weight, and in each series of analogous elements rises with it; but analogous elements with higher atomic weights than 35 have approximately the same mobilities. For compound ions the mobility is for the most part an additive property; to a continuous addictive change in the composition of the ion corresponds a continuous but decreasing change in the mobility. Isomeric ions[1] and metameric anions of analogous constitution have equal mobilities. Metameric cathions, on the other hand, have different mobilities, the mobility increasing with the number of carbon atoms joined directly to the nitrogen atom. Comparing anions with anions and cathions with cathions it may be said that the mobility of the ions varies inversely as the number of atoms it contains. A retarding effect is, in general, produced (*a*) by the addition of H, C, Cl, or Br; (*b*) by the replacement of H by Cl, Br, I, or by the methyl (CH_3), amido (NH_2), or nitro group (NO_2); (*c*) by the replacement of any element in an ion by a chemically analogous one of higher atomic weight (except O and S); (*d*) by the change of amines into acids, of sulphonic acids into carboxylic acids, of acids into cyanamides, of bicarboxylic into monocarboxylic acids, and of monamines into diamines. In all cases the additive effect upon mobility of any particular change is largely obscured by considerable constitutive influences, increasing with increasing symmetry and decreasing with the number of atoms in the ion; consequently, the mobility of ions must tend to a minimum value, which, according to Bredig, appears to lie between 17 and 20 for both the positive and negative ions. The differences arising from constitutional differences steadily diminish until they finally disappear as the number of atoms increase, for, according to the determinations of Ostwald and Bredig, the mobilities of the ions composed of more than 12 positive atoms or 40 negative atoms depend upon the number of atoms entering into its composition, and not upon their nature.

(*c*) *Relation of Number of Ions in Solution to Constitution.* The number of ions in a solution is determined by the number formed in the splitting up of a molecule and the number of molecules so split up. The number of ions produced by a molecule of a compound is conditioned by its constitution. The simplest mode of ionization possible is

(1) Bredig, *Zeitschr. physik. Chem.*, xiii., 191 (1894).

where the compounds yield primarily two ions, but even this case is complicated by the power which ions possess of associating themselves with neutral molecules to form complex ions. In the case of compounds yielding three or more ions on complete dissociation, the results are obscured by the possibility of *ionization in stages*. The degree of ionization of the molecules in a solution is primarily conditioned by dilution, and secondarily by temperature. The data available for the formulation of a simple law of relation are extremely meagre; perhaps the development of Abegg and Bodländer's *Theory of Electro-Affinity* may help to build up a comprehensive theory of ionization, more particularly as its application to the formation of complex ions has given the most promising results.

There is a set of electro-capillary phenomena which, according to W. N. Shaw (1) constitutes an essential part of the mechanism of the electrolytic process. If an electric current be passed through a narrow glass cell divided by a porous partition into two compartments, and filled with some solution, there is, besides the changes in the concentration of the liquid at the electrodes, a bodily drift of the molecules of the liquid solvent through the porous wall in the direction usually of the current. These phenomena, to which the name of Electric Osmose has been applied, has been experimentally studied by Wiedemann (2) and Quincke (3). It has been found the amount of electric osmose is proportional to the current strength of the battery, but independent of the area and thickness of the plate. It varies also with the nature of the solution, being in a measure proportional with its specific resistance. If the liquid is not allowed to overflow in the test-cell, the pressure on one side of the porous cell will increase, the final pressure being proportional to the E.M.F. between the faces of the partition, and consequently to the current through it. Again, for a given current it varies inversely as the area of the surface of the porous wall and directly as its thickness. A somewhat similar motion through liquids of particles of fine clay, under the influence of an external electro-motive force have been observed by Quincke, Wiedemann and others. It has been suggested by W. N. Shaw, that the motion of the liquid proceeds from the drifting of complex ions made up of an ion of the solute associated with a large number of neutral molecules of the solvent. This view cannot altogether be accepted. In

---

(1) "B.A. Report" (1890), 202.

(2) *Elektricität*, ii., 166.

(3) *Pogg. Ann.*, cxiii., 573 (1861).

accordance with Quincke's theory of electric osmose, the movement of the particles, in a solution of colloids in water, has been found to depend upon the nature of the colloid and of the solvent. Hardy (1) has noticed that proteid modified by heating to the boiling point, when dissolved in water, show a reversion in the direction of its movement under electric influences, varying as the reaction of the containing fluid is altered from acid to alkaline and *vice versâ*. In a medium very faintly alkaline, the proteid molecules move against the current, whilst in one slightly acid they move with it.

Having so far considered the chief facts of electro-chemistry that have a bearing on local medication, we are in a position to shape our course in accordance with the methods we have decided to employ. The two modes of electrical medication that have hitherto been employed are Phoresis and Osmosis.

PHORESIS requires for its administration an electro-motor supplying a *unidirectional* current. It is immaterial, from a physico-chemical standpoint, whether the current so employed be continuous, pulsatory or intermittent, provided that the direction of its flux be a constant. From a physiological standpoint, however, the choice of electro-motors is more limited. The response of muscles and the nervous system to electrical excitation, the phenomena of fatigue and of polarizations of the tissues, are important factors in determining our choice of a source of electric energy. Where the number of excitations falls below 30 or exceeds 10,000 per minute, the amount of muscular contraction produced by pulsatory or intermittent currents is, *ceteris paribus*, almost negligible. It is evident, therefore, that phoresis can advantageously be practised (*a*) with a continuous or galvanic current; (*b*) with a pulsatory current derived from the primary of a faradic coil, using slow interruptions of less than 30 per minute ; or (*c*) with a high frequency current rendered intermittent by a special arrangement. It is also advisable, for electro-chemical reasons already mentioned, to employ as the menstruum of solution either water or a solvent with a high medial energy. In so far as the concentration of the solution employed has an influence upon ionization, one has to consider whether the ions that one desires to introduce into the system are to be primary ions or complex ions. Although this is to a large extent a question of valency, there is but little doubt that the state of dilution has an influence upon it. In a moderately concentrated solution (1 to 5 per cent.) of most of the simpler salts dissociation is comparatively complete, the ions passing into the system being primary

(1) *Journ. Phys.*, xxiv., 288 (1899) ; *Proc. Roy. Soc.*, lxvi., 110 (1900).

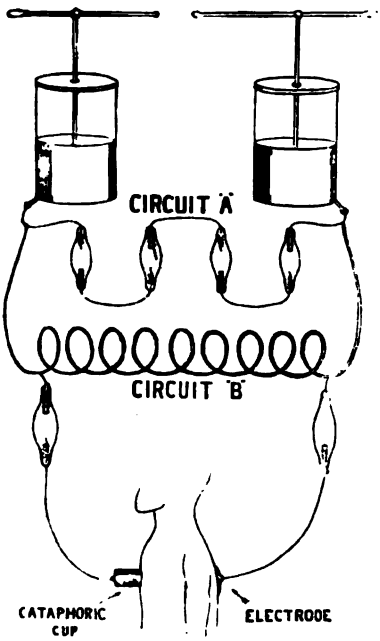
ions. In very dilute solutions of such salts the cathions entering the body are more or less hydrated; that is to say, they are compound ions, formed by the association of an electro-positive ion with one or more neutral molecules of undissociated water. In a 2 per cent. solution of an acid salt no difficulty is experienced in introducing the acid radical. The same cannot be said of the metalion or basic radical. In such a solution the dissociation of the basic molecules is incomplete, so that hydrion is both the predominating ion and the one that possesses the higher velocity. In very dilute solution of acid salts the cathions are hydrated; whilst the anions are chiefly metalions, which, being present in relatively larger numbers, take an important part in electric conduction. In salts formed by the union of acid and basic radicals of high valency, the state of concentration of the solution is to be regarded. By using a highly concentrated solution polymerization and ionization by steps may be turned to account, so as to introduce a certain percentage of the complex ions. In very dilute solutions, on the other hand, ionization is more or less complete.

ELECTRIC OSMOSE, as a method of drug medication, is, from an electro-physiological standpoint, the more interesting phenomenon. It demands the suspension or quasi-solution of the medicament in a solvent of great resistance. Ether, chloroform, alcohol, and glycerine are as menstrua preferable to water for chrystalloids. In electro-serum-therapy and electro-organo-therapy, where the nuclear molecules are colloidal in nature, water affords us the best medium of suspension. If the experiments of Reus be accepted as the criteria of judgment, alternating currents, more particularly those of high frequency, are the currents *par excellence* for medication by this method. For mixed menstruum an intermittent current is to be preferred. The reaction of the serum solution determines the choice of electrode from which to introduce it. Consequently, attention to this point is the surest guide to successful treatment.

In working with a continuous current, galvanic phoresis and electro-organo osmosis can be practised by connecting the patient by means of an indifferent electrode to the passive pole of the electro-motor. A solution of the medicament in the most suitable condition of concentration is introduced into a cataphoric cup, connected with the active electrode, and brought into immediate relation with the part to be treated. A current rising from 0 to 10 milliampères is then turned on to test contact, and when this is found to be perfect the current is rapidly increased to 25 to 40 milliampères. The sessions, as a rule, seldom extend beyond 20 minutes; for a general average with 2 to 5 per cent. solutions 12 minutes are sufficient.

In employing a pulsating galvanic current, the reaction of the patient, as evidenced by the state of muscular contraction, must first be carefully tested, so as to determine both the number of interruptions and the length of primary that can best be employed. This having been experimentally determined the same lines of electric medication already alluded to are to be followed. For those who do not possess a high frequency machine, this method affords the best means of medication in electro-organo-therapy.

Although the sinusoidal current generated by an alternator is theoretically available for electric osmose, there is



very great difficulty in preparing quasi-solutions of the ordinary salts of sufficiently high resistance to render this current really serviceable. Experience points to the resinoids and the aromatic series suspended in a glycero-alcoholature as the best solutions for use. With a high frequency current the osmosis of the quasi-solutions is more marked, but the difficulty of preparing solutions for such use is still very real. I therefore now employ the following method, which allows of the introduction of a certain amount of the drug by phoresis: I insert into the secondary circuit of the condensers—the B circuit of Sir Oliver Lodge—two or more choking tubes connected in series. This forms the branch circuit marked "A" in the accompanying illustration. The circuit marked

"B" is connected in parallel with the preceding. The shunt circuit, marked "C," of which the patient forms a part, is derived from the last-named. One indifferent electrode and a cataphoric cup are used to connect the patient with the source of electric energy. Where it is desired to treat more than one place at the same time, the other cataphoric cup is connected in parallel with the first if the ionic natures of the two solutions are similar, or it replaces the indifferent electrode if ions of opposite sign have to be introduced.

Dr. HORACE MANDERS: The arrangement of the diagram as shown is symmetrical; is there then any particular reason for the cataphoric cup being placed on one side of the circuit more than the other?

As the choking tubes in circuit "A" must have a considerable influence over the wave length of the oscillation, or may even change its oscillatory character and cause a unidirection lysis, it would appear that it would make a difference according to which condenser received the first positive charge.

Dr. DONALD BAYNES congratulated Dr. Wright on his paper, and would like to ask Dr. Wright what advantage a cataphoric cup in galvanic phoresis has over an ordinary pad of absorbent cotton wool covered with lead or silver foil? I can understand the use of this cup in H.F.C. phoresis. I suppose H.F.C. phoresis as described is very similar to static phoresis. Again, the proof of introduction of drugs by galvanic phoresis is easily proved, also that some drugs are only introduced by the anode, others only by the cathode—for example, Leduc's experiments with the rabbits and strychnia and cyanide of potassium. Can such proofs be shown in H.F.C. phoresis?

Dr. H. MCCLURE called attention to the dielectric factors in the human body and enquired how they are effected by this current and how the total electrical energy is expended by electrolysis, partly in the production of heat—and what else?

The paper was also discussed by Drs. HEATON, BATTON, HERSCHELL, and R. MORTON.

REPLIES.

In replying to the questions asked, Mr. Clarence Wright said:

The tubes employed were a modification of the ordinary Villard type: the spiral anodal electrode, however, was constructed of finer wire and possessed a greater amount of self-induction. Vacuum choking tubes worked fairly well, but rectification was better with tubes filled with an electrolytic solution of high resistance—say glycero-alcohol.

In comparing the relative penetration of the drug introduced by the two methods, it must be remembered that all the cells of the body possessed a covering that was of the nature of an impermeable membrane; so that whatsoever the method of percutaneous medication employed the immediate reaction of the cells to the mediciment was a question of osmosis. Both methods allowed of the introduction of the remedies through the skin to the deeper parts.

He produced some cataphoric cups, and explained their construction. He next briefly outlined the history of local medication by electrical methods, and cited cases of cures recorded. The sign of the ion determined the pole from which it should be introduced. The penetration of the drug was established by urinanalysis, both chemical and spectroscopic. Experiments on animals had, as far as he knew, only been made to establish penetration by phoresis. The cellular tissues of the body were practically electrolytic solutions of various kinds, separated by diaphragmatic partitions, and reacted in much the same way as in Reus' experiments. Their permeability was a factor of moment. The relation of the dielectric constant to the association factor would be found set forth in footnote (1) page 421.

He concluded by drawing attention to various soloids, ionettes, and osmophoroids prepared at his suggestion by Messrs. Burroughs, Welcome & Co.; Hearon, Squire & Francis; and C. J. Hewlett & Sons. These ensured correct dosage and saved the time of the operator, who was spared the trouble of stocking solutions of various strengths, which, to say the least, were liable to undergo untoward changes on keeping.

NOTICES.

Members taking part in discussions or making remarks on papers, etc., are earnestly requested to give their notes on same to the Secretary at the end of evening, so that the proceedings may be complete and not delay the prompt publication of the Journal.

PUBLICATIONS.

17.—The proceedings shall be published in such a manner and at such times as the Council may direct. A copy shall be forwarded to each Honorary and Corresponding Member of the Society, and to every Ordinary Member whose

subscription is not more than one year in arrear. Fourteen days' notice should, whenever possible, be given to one of the Secretaries by any member who wishes to show a clinical case or to make a communication to the Society. A copy of the paper in a form fit for publication in the proceedings must be furnished at the same time. The paper shall be the property of the Society for publication in the proceedings, without prejudice to the author's right to reprint or insert in any recognised medical paper or periodical. In all such cases the author shall state that the paper was read before the Society.

Members are reminded that the annual subscription (one guinea) became due last January and should be sent to either Honorary Secretaries at their earliest convenience.

On November 25th Dr. Gamlen has kindly promised a paper illustrated with lantern slides.

In December will be held the Annual Exhibition.

MEDICAL

Electrology and Radiology.

No. 12. DECEMBER, 1904. Vol. V.

EDITORIAL.

In the November number of the *Philosophical Magazine* Rutherford gives a further account of his work on the "Transformation Products of Radium." He previously, in the Bakerian lecture, established the existence of the short-lived radio-active forms A, B and C in the solid deposit which the gaseous emanation leaves on the objects it touches. He showed that by repeated emission of ex-particles the radium atoms assume the A and B forms and that the B form passes to the C form without radio-active display.

He has now discovered two further products which he identifies with Hoffmann's radio-lead and Madame Curie's polonium, and which he calls Radium-D and Radium-E.

He gives the following table of the various products of the decomposition of radium and the time required for each body to be half transformed into the next.

Radium	about	1,000 years
Emanation	,,	4 days
Radium-A	,,	3 minutes
Radium-B	,,	21 ,,
Radium-C	,,	28 ,,
Radium-D	,,	40 years
Radium-E	,,	1 year

Of these the first three and the last emit X-rays only; Radium-B emits no rays; Radium-C emits α, β and γ-rays; and Radium-D emits β-rays only.

The D and E substances are separable in two ways: either by a process of fractional distillation at 1,000° C.; or by immersing in a sulphuric solution a plate of bismuth on which the D atoms collect.

The author gives their probable properties as follows: The β-rays' activity of Radium-D should have fallen to half

their value in 40 years. In consequence of the change from D to E, which gives off X-rays, the X-ray activity should increase to a maximum in a few years and decrease to half value in 40 years. The rate of change of D is 25 times as fast as radium itself, so the activity on separation, measured by the number of electrons discharged per second, should be 25 times as great as from an equal quantity of radium.

Radium-E should emit only X-rays and its activity should fall to half in one year. Weight for weight, it should emit about 1,000 times as many ex-particles as freshly-prepared radium.

This discovery simplifies the list of radio-active substances in showing that Marckwald's radio-tellurium and Madame Curie's polonium are probably identical with Radium-E.

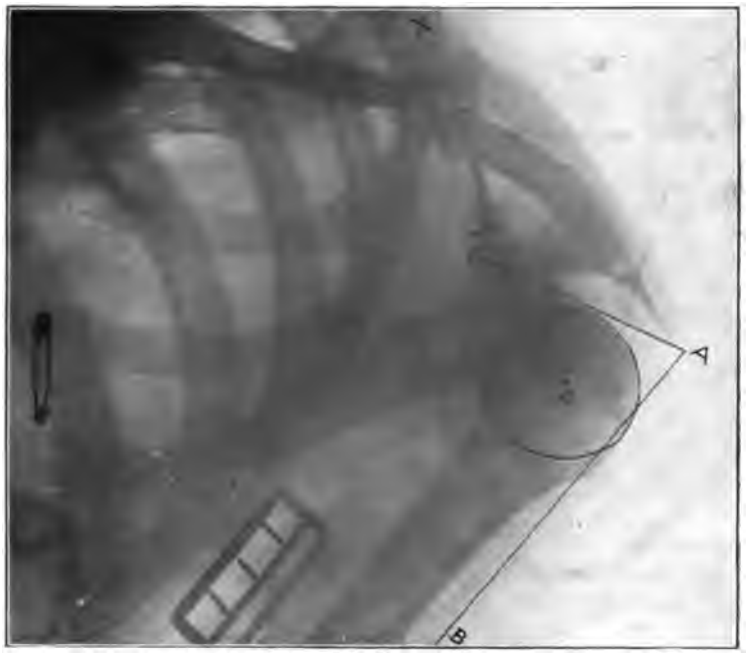
THE REGULATION OF THE X-RAY TUBE.—Under this heap J. Sherman Wright first considers the physical conditions in an X-ray tube referring to the process of ionization of the gas, by which it is made an electrical conductor as demonstrated by J. J. Thomson. Wright concludes that the regulation of the tube requires (1) a tube of glass as thin as is consistent with strength; (2) an auxiliary tube, attached to the main tube and sending emanations into it (the addition of some volatile salt may be an advantage). This auxiliary tube should have a sharp gap adjustment; (3) an adjustable cathode; (4) change of voltage outside the tube.—*New York Med. Journal and Phil. Med. Journal*, July 30th, 1904.

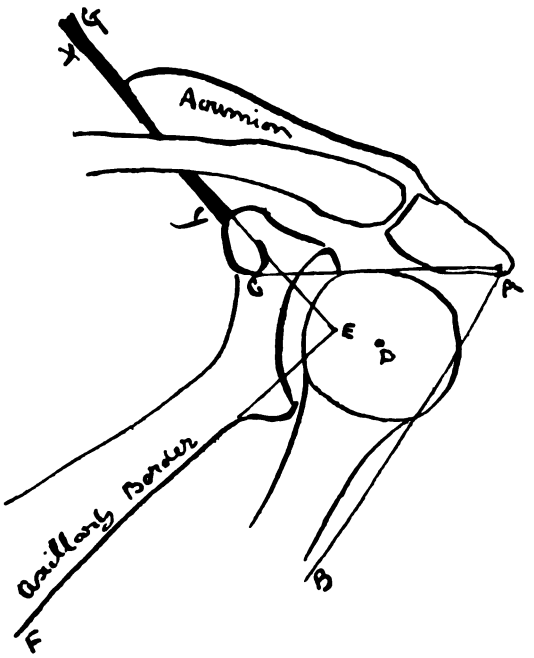
* * *

RADIUM.—Einhorn discusses the method of radium treatment, its physiology and diagnostic value and also the therapeutic results he has obtained in the treatment of carcinoma of the œsophagus. He describes this means of applying the radium. For this purpose it is encapsulated and attached to suitable flexible cord for withdrawal. He reports nine cases of œsophageal cancer treated with radium. In six there was some improvement as regards stricture. Three cases were not improved. The latter cases were not regarded as having received adequate treatment. There was a diminution of pain in some of the cases, and Einhorn is of the opinion that the method is worthy of further trial.—*New York Med. Record*, July 30th, 1904.

Remark.—From the writer's experience with radium in the treatment of inoperable and incurable malignant pelvic cases, the permanency of the improvement in the above class of cases is regarded as very questionable. There may be an amelioration of the symptoms for a time, but the disease ultimately pursues its inevitable course.—THE AMERICAN EDITOR.

[See Dr. Shenton's article:—
"X-Rays in the Diagnosis of Joint Conditions," pp. 433-434.]





[See Dr. Gamlen's paper:—

"The Treatment of some Skin Diseases by X-Rays, etc.," pp. 450–470.]

Fig. 1.

Lupus of Nose before treatment.

Fig. 2.

Lupus of Nose (fig. 1) after X-rays, 16 sittings of 15 minutes' duration.

Fig. 3.

Lupus of Face before treatment.

Fig. 4.

Lupus of Face (fig. 3) after X-rays, 20 sittings of 15 minutes' duration.

[See Dr. Gamlen's paper:—
"The Treatment of some Skin Diseases by X-Rays, etc.," pp. 450–470.]

Fig. 5.

Lupus of Nose before treatment.

Fig. 6.

Lupus of Nose (fig. 5) after Ultra-Violet lamp, 12 sittings of 15 minutes' duration.

Fig. 7.

Rodent Ulcer before treatment.

Fig. 8.

Rodent Ulcer (fig. 7) after Ultra-Violet lamp, 8 sittings of 10 minutes' duration.

[See Dr. Gamlen's paper:—

"The Treatment of some Skin Diseases by X-Rays, etc.," pp. 450–470.]

Fig. 9.

Rodent Ulcer before treatment.

Fig. 10.

Rodent Ulcer (fig. 9) after X-rays, 10 sittings of 12 minutes' duration.

Fig. 11.

Parasitic Eczema before treatment.

Fig. 12.

Parasitic Eczema (fig. 11) after X-rays, 8 sittings of 10 minutes' duration.

X-RAYS IN THE DIAGNOSIS OF JOINT CONDITIONS.

By EDWARD W. H. SHENTON, M.R.C.S. Eng., L.R.C.P. Lond.

(Continued from p. 392.)

[On line 21, p. 392, read "and *no* real dislocation is present."]

When the arm lies close to the side and the shoulder joint is viewed from the front, the tip of the acromion process and the shaft of the humerus can easily be made out.

If a line is drawn through the tip of the acromion process vertically downwards parallel with the humeral shaft it will be found to touch, or more usually to cut off a small portion of the head of this bone.

This fact is important in the investigation of suspected dislocations of the upper end of the humerus or fracture of its surgical neck.

This line is represented by *AB* in fig. 1. By joining the tip of the acromion process to the tip of the coracoid a line is found, *AC*, which just meets the uppermost edge of the humeral head. If the head be regarded as a rough circle and a straight edge is laid along the axillary border of the scapula, the centre of this circle will fall to the outer side of the line *EF*.

Bearing in mind these three diagnostic lines, the observer is enabled to clearly grasp the position of the head of the humerus as it lies normally, and he will be able to estimate the amount of displacement when such is present.

When the line *AB* does not meet or cut the head of the humerus, dislocation of a subcoracoid nature or fracture of the surgical neck of the humerus must be suspected.

It is clearly evident that as the head moves inwards it will avoid the line *AB*. But in the case of a fracture of the surgical reck the reason of *AB* not meeting the humeral head is not so apparent. The explanation is found in the fact that though the head remains in position the shaft of the humerus is usually tilted inwards at its upper end, and *AB* being parallel with the shaft is similarly tilted so that the lower end is set out a little further from the body.

In nearly all skiagrams of this region a long dark mark is visible at *X—Y*, which indicates the position of the upper border of the scapula.

This line, if continued, will meet *FE* at a point well inside the centre *D* of the head and will often prove of value as confirmatory to the other lines.

It must be clearly understood that the arm must be placed close to the side during the radiographic process and the patient must be viewed from the front, that is, the plate must be in contact with the front of the shoulder. Nearly all injuries to the shoulder are better viewed from in front than from behind, in accordance with the rule that screen or plate should be placed as near the injury as possible.

THE COMPLETE ABSORPTION OF A LARGE UTERINE FIBROID BY THE X-RAY.—J. E. Helt reports a case of fibroid tumour of the uterus in a woman 45 years of age, which had existed for 12 years, causing the patient much suffering from pain, pressure, symptoms and hæmorrhage. The general health had become much impaired. The growth filled the whole abdomen, extending above the umbilicus and was of the multi-nodular, intra-mural type. 23 daily applications of 15 minutes' duration, with a hard tube placed 15 inches from the skin was used. Helt does not state whether the distance referred to the anode or the pass-wall of the tube. The tube was excited by a 16-plate Wimshurst machine. To protect the skin from burning, vaseline was applied. At the end of 23 days, slight dermatitis was apparent. The treatment was suspended for 10 days, and the redness disappeared. Ten subsequent exposures were made, when the patient was advised to return home and await results. The hæmorrhages had ceased, and there was less pain, but there was no diminution of the growth. The skin had become slightly tanned. A week after her return home, she was found by the physician called upon to treat her to have a burn extending from the umbilicus to the pubis, slightly larger than the size of a man's hand. She suffered intense pain. Despite every means used by the surgeon, the pain continued and healing progressed very slowly. When the wound presented a square inch area of $2\frac{1}{2} \times 2\frac{1}{2}$ inches, the healing stopped and the pain became unbearable. A thick sole-leather, like substance of from $\frac{1}{4}$ to $\frac{1}{2}$ inch in thickness, very dense and of an ash-brown colour, was removed under chloroform. The lancinating pain ceased at once, the wound took on a healthy look and slowly closed in. The hæmorrhage and the pressure symptoms are gone, and the tumour mass has disappeared. At the time of the report the patient was in splendid health, said she never felt better in her life, and her appearance corroborated the statement. Helt concludes that the vaseline affords no protection to the skin from the action of the ray.—*Advance of Therapeutics*, September, 1904.

DIGEST OF CURRENT AMERICAN LITERATURE.

THE RÖNTGEN RAYS.

ZINC-MERCURY ELECTROLYSIS AND CATAPHORESIS.—A case of Fibro-myxo-sarcoma of the sacrum of large size, successfully treated by cataphoric operations, with preservation of the sphincter. Under the above caption Massey reports the case of a woman aged 26, who had had two difficult child-births several years since, but at the time of coming under care, October, 1903, had a child 18 months old, the delivery of which had been normal. A tumour was discovered in the pelvis in 1903 and an abdominal section was performed at the Hahnemann Hospital on September 6th, 1903. The surgeon finding that the tumour was attached to the sacrum, closed the abdomen and gave an unfavourable prognosis. Dr. W. W. Kem, of Philadelphia, who next saw the patient, confirmed the diagnosis of sarcoma, and said that an operation for its removal would be dangerous and would result in paralysis. Physical examination revealed a hard growth in the posterior portion of the pelvis. Rectal examination showed this posterior to the rectum and attached to the inner surface of the sacrum by a broad base. The upper edge could not be reached by the finger. The growth was developing rapidly. On October 5th, 1903, the patient was operated upon at her own home, under anæsthesia. The negative contact, especially prepared, was placed on the cot upon which the patient reclined in the Sims' position. An incision was made through the skin over the upper portion of the coccyx in order to admit a sharp pointed zinc-mercury electrode somewhat larger than a lead pencil. The electrode was forcibly thrust through this opening into the still healthy tissues surrounding the coccyx and directed upward into the middle of the growth by a finger in the rectum. The current was turned on and gradually raised to 1,600 milliampères, after two other electrodes of smaller size had been inserted alongside of the first and was allowed to flow steadily for three hours. A sharp secondary hæmorrhage followed two weeks after the operation, which was controlled by pressure. On the 21st day after the operation three of the bones of the coccyx and half of the tumour mass came away floodlessly. It was seen through the three-inch wide opening thus made, that the whole growth had not been destroyed, a red mass showing plainly at the bottom of the sinus. Destruction of the posterior rectal wall had taken place and all fæcal matter passed through the wound. In a month the patient's general condition warranted a second and final application. This was made on November 4th, 1903. 1,200 milliampères of current were used and maintained for two hours. The remainder of the mass somewhat larger than a man's fist came away 16 days later, and three days afterwards the detached and devitalized first segment of the coccyx was lifted out of the wound. The anus was kept patulous by the use of hard rubber tubes, and on January 13th, 1904, the patient had her first normal movement through the anus. The patient presented with

the report, seven months later, was in unusually good health, with no evidence of fulness or growth of any kind in the pelvis or elsewhere. The opening one year after the operation admitted a Simpson's sound.—Histologic examination of a portion of the growth, Philadelphia Clinical Laboratory.—*Advanced Therapeutics*, October, 1904.

* * *

CHRONIC ULCERS CURED BY METALLIC ELECTROLYSIS, AFTER THE X-RAY AND HIGH FREQUENCY CURRENTS HAD FAILED.—Francis B. Bishop reports a case of obstinate ulceration in a woman aged 60, under the inner canthus of the left eye of about the size of a silver 25-cent piece, which at the time of coming under observation discharged a thick dirty pus that dried and came off in a scab. The chronicity of the ulcer was unmistakable, and it was possibly malignant. X-ray treatment to the part of dermatitis caused a more rapid increase. Two weeks of high frequency currents produced no beneficial result. Treatment by zinc-mercury electrolysis and cataphoresis was decided upon. The ulceration was thoroughly cleansed and smooth. Zinc-electrode well amalgamated with mercury was connected to the anode and held firmly against the ulcerating surface, as well as moved around so that every portion of the surface came in contact with it. A current of eight milliampères was used until the entire surface had become white. Improvement began at once, and after 10 treatments recovery was complete. A similar ulcer had begun to form around the nipple of the left breast, and on the right side of the nose. They were treated at the same time and in the same way with the same result. Bishop believes that this method should be employed in those cases which resist the X-ray.—*Advance of Therapeutics*, September, 1904.

Remark.—In the systematic experimental work carried out by Gautier some 12 years ago with oxidizable electrodes at the anode and which he termed metallic interstitial electrolysis, his work was done with copper alone. The method had been used in isolated instances before. Its use by Onimus and Prochornik is a matter of record, they having used from 80 to 100 milliampères with a copper sound connected to the anode in blenorrhagia of the cervix. The principles of this method were outlined by Butler and Stephenson and Jones, but until Gautier's scientific experimental work the method was used in isolated instances only and more or less empirically. Since Gautier's original experiments, this method has been in constant use but among a limited number of electrotherapeutists only, some have worked with copper, some with silver, others with zinc and others again with a zinc-mercury amalgam. The fundamental principle is the same in each and every instance. The nature of the tissue reaction established and the pathological condition should govern the selection of the one or the other metal. The writer has used them all in varying pathological states, according to the indications to be met. To Massey the credit of using zinc-mercury amalgam with high ampèrage in malignant conditions is due. By

his use of high ampèrage and anæsthesia, under all circumstances a surgical one, the method has become in his hands a surgical procedure of major importance. To the writer's mind it is superior to the X-ray and radium in this class of cases. There is need, however, for careful experimental work to show how much the result is influenced by (1) the zinc-mercury nascent salt ; and (2) by the ampèrage. In this connection may be mentioned a case of extensive osteo-sarcoma of the superior maxillary bone, involving the whole of the alveolar arch on the right side, extending upward to the median line of the jaw so as to displace the tongue to the left side and back part of the oral cavity reported by Dr. W. J. Herdman. The bone was rarified and yielding to pressure, the tumour nodular in surface and quite vascular, having attained its growth in four months. This Herdman treated by anodal electrolysis. Six applications were made in six weeks. Gold-plated needles were thrust into the growth from its periphery to its centre at different settings and a current of 15 milliampères used. After the second treatment the growth began to diminish and after the sixth it had receded to the lower level of the jaw. A two per cent. cocain solution was used to annul pain. There was no unbearable pain and no loss of blood. The results were equally good as with the zinc-mercury amalgam and high ampèrage. In the same connection a similar case treated with radium by Dr. Robert Abbe may be instanced. The result was also satisfactory, although the giant cell still remained. When the continuous current is used the living cells in the immediate vicinity of the anodal needle, where there is the greatest current density, are disintegrated and destroyed. If living parasites or bacteria are concerned in the development of the growths, they meet a like fate. These different methods are instanced simply to point out the need for careful experimental work, in order to meet intelligently the indications for the one or the other method. The fact that the changes established by (1) anodal electrolysis, and (2) cathodal electrolysis result in the formation of scar tissue, non-retractile at the anode and retractile at the cathode, while with oxidizable electrodes at the anode scar tissue is not formed, is a strong plea for the use of oxidizable electrodes at the anode as against the simple polar action even though the results are equally good. The method is precise and is not fraught with an element of danger as is the X-ray and radium. The use of oxidizable electrodes at the anode has during the past 12 years sufficed, in the writer's hands, in simple and fungoid endometritis, in gonorrhœal salpingitis, in rhinitis, both atrophic and hypertrophic, in conjunctivitis and trachoma and in hyperplastic tonsils. It has also served in tubercular glands as well as cervical and intra-mural fibroids. Unless the condition is due to retained membranes and sepsis, curettement is never practised, although formerly used. The action of the metallic ions diffused from the positive pole is of such a nature as to establish tissue changes leading to the normal. The method is capable of replacing many minor surgical measures as well as major surgical conditions when used as per the method of Massey. —THE AMERICAN EDITOR.

* * *

LIGHT.

MY EXPERIENCE WITH LIGHT THERAPY. — Under the above title, Rosenburg makes an additional report of his use of Light. He details 27 cases, in all of whom pain was a predominant symptom. The relief of it was almost universal from the use of the light of a 35-ampère arc. In addition to cases of neuralgia, sciatica, one of locomotor ataxia, of acute bronchitis, of pulmonary emphysema, etc., he reports a case of gonorrhœa, with pain in urethra and perineum, disturbed sexual functions, premature and nocturnal emissions, scanty urethral discharge always present in the morning containing leucocytes and gonococci, in which all local and internal medication was discontinued and light applied over the penis and perineum for one hour daily. The gonococci disappeared from the discharge after six treatments, and after two months' treatment there was no longer any urethral discharge. There is marked improvement in the patient's general and sexual condition, and he is entirely free from pain. Prompt relief was also obtained in a case of pelvic peritonitis giving a history of gonorrhœa. He concludes that the ultra-violet rays from an even carbon arc of high amperage are a specific in acute muscular pains such as lumbago, torticollis and plurodynia, and are also of value in relieving the pain of acute and chronic neuritis, effecting recovery in most cases, especially acute forms. He finds them of prompt and certain curative effect in acne and furunculosis, of great benefit in acute and chronic pleurisy and bronchitis, and yielding encouraging results in gonorrhœal peritonitis and catarrhal inflammations of the deep urethra and adjacent structures. Relief from the pains of locomotor ataxia is also obtained by the use of light.—*New York Med. Record*, October 22nd, 1904.

Remark.—After 11 years' use of light in the treatment of a wide range of disease, it is both interesting and satisfactory to note the confirmatory evidence of the newer workers in this fascinating field. It seems unfortunate, however, that the results obtained should be so exclusively attributed to the ultra-violet frequencies. Valuable as these short high frequencies of oscillating light energies are, they are far from being the entire energy of radiation, active in securing therapeutic result. This must be attributed largely to a complex of all the frequencies of the spectrum of the iron-carbon arc, but especially to the penetrating blue-violet frequencies. The spectrum of the iron-carbon arc is very rich in all the more refrangible frequencies from the blue into the ultra-violet. It is a matter of routine practice in the writer's practice to relieve similar conditions to these instanced by means of the light of both carbon and iron-carbon arcs.—THE AMERICAN EDITOR.

NOTES AND ABSTRACTS.

ANNALES D'ÉLECTROBIOLOGIE ET DE RADIOLOGIE, 1904.

No. 1. M. Raffaele Pisani, in a paper on the "Thermogenic Properties of the Electrostatic Bath," finds, as the result of numerous experiments, that static electricity in the form of a bath raises the amount of heat-production of the body. This elevation is greater with the positive than with the negative bath, and is proportionate to the duration of the charge and also to its intensity, varying from a minimum of ten to a maximum of 32 calories.

Mm. L. Bayer and Albert Penninkx discuss the treatment of ear troubles by static electricity. "This treatment (franklinisation), in no degree painful, rapidly removes vertigo as well as its concomitant symptoms: cephalgia, noises in the ears, uncertainty of gait, particularly in the dark." "Pierson-Siegling has had success with the breeze directed on to the ear, treatment lasting five minutes at first, then a quarter of an hour and carried on for four weeks." The authors of this paper place the patient on an insulating stool, to which they connect the negative pole of a Bonnetti machine; the positive pole is attached to a metal rod with a blunt pad which is applied to the auditory passage. Sparking is avoided except in cases of atrophy of the tissues, when it is of great value. A number of cases of chronic post-nasal catarrh, otitis media (chronic), "noises in the ears," etc., are cited, in which excellent results were obtained.

No. 2 contains an able paper on the "Therapeutic Action of High Frequency Currents in Trophic and Vaso-motor Troubles," by M. E. Bonnefoy. Ten cases of rheumatic and gouty nature are described at length, and the following rules are formulated:

1. The intensity of the current should be kept between 350 to 450 m.a.

2. The susceptibility of the patient should be taken into account by commencing with short *séances*, not exceeding ten minutes; the duration may be progressively increased to 15 minutes.

3. Daily applications are advised until the following signs are observed:

"When the patient is placed for the first time on the condensation couch he experiences no sensation, except perhaps a slight tingling in the hands which are holding the handles. Then, after two or three *séances* generally he notices a certain degree of warmth in the fore-arm, which, after several more applications extends to the trunk and finally the lower limbs. When this last sensation is only felt at the end of the treatment one must continue daily, but when it remains for some minutes after the current has been switched off, the intervals between the *séances* may be progressively increased."

A case of splenic leucæmia, treated by X-rays, is brought forward by Mm. Th. Guilloz and L. Spillmann. The patient was a girl of 27, suffering from profound anæmia, with intense cardiac

souffle, enlargement of the spleen, subcutaneous hæmorrhages, epistaxis, chronic enteritis, etc. The action of the rays was limited to the splenic area, the tube was excited by a 50 c.m. spark coil, with a Wehnelt break, working at a voltage of 40 to 110. The anti-cathode was placed 30 to 40 c.m. from the part and the quality of the rays determined by Benoist's radio-chromometer at 6 to 7. Treatment was conducted every few days for five months, with one interval of two months. An examination of the blood was made frequently during the whole period, with the result that the corpuscles steadily diminished in number, but especially the leucocytes. At one time, however, there was an increase in the red corpuscles, while the white still continued to decrease. The actual numbers at the beginning of the treatment were—red 2,724,000, white 11,200 per c.mm.; at the end—red 1,560,000, and white 4,400.

At the same time M. Spillmann noticed a diminution in the size of the spleen and improvement of the general health. Epistaxis ceased during the early part of the treatment.

No. 5 contains a number of careful observations by M. H. Thiellé on "The Treatment of Tuberculosis by High Frequency Currents." His deductions are based on the study of the respiratory exchange, carefully compiled tables being given in each case described. Seven out of the twelve cases given here are reported cured, and four of the remaining five are doing well; eight of the patients were workmen insufficiently fed and in bad hygienic surroundings. The method of treatment was by the high frequency effluve. The figures given here go to prove the statement of Mm. Robin and Binet that:

1. The respiratory exchanges are higher in tuberculous individuals, and in those predisposed to tuberculosis than in the healthy man.

2. That this super-activity in the gaseous exchanges becomes lower, and tends to approach the normal when a cure is in progress.

M. NINO SAMAJA completes in this number a series of papers on the "Site of Tonic and Clonic Epileptiform Convulsions," in which numerous experiments are recounted. He comes to the following general conclusions:

1. The motor cortical zone is the sole centre* for clonic convulsions in the adult dog and cat. The remainder of the cerebro-spinal axis can only give in these animals tonic convulsions. In mammals, lower in the animal scale, the motor cortex is not the site of a convulsive centre.

2. The bulb or the isthmus are the site of clonic convulsions in the guinea-pig and rabbit.

3. The medulla in all its length, among all mammalia, is the site of a centre exclusively tonic; it never provokes clonic convulsions. In the frog, however, it does give rise to clonic convulsions.

We see then that the clonic convulsive centre mounts

* "Convulsions being a pathological phenomenon cannot have a special centre. We mean to designate by the word 'centre' the part of the cerebro-spinal axis where excitation produces either clonic or tonic convulsions."

progressively in the animal scale from the medulla to the cerebral cortex.

In man the site of tonic convulsions is exclusively basilar; that of tonic convulsions is cortical.

* * *

"GENERAL METHOD OF METRORADIOGRAPHY" is the title of a lengthy article by M. G. Contremoulins. He has devised a quantity of intricate, and we imagine, expensive apparatus for use in localising foreign bodies. No doubt by their help very careful observations may be taken; they must, however, be somewhat terrifying to the patient and, we think, unnecessary from the operator's point of view. Most English radiographers are quite content with the much simpler methods already in use,—that of Mackenzie Davidson, for example, which will give us the position of a foreign body to the eighth of an inch, and which is sufficiently well known not to need description here.

* * *

ARCHIVES D'ÉLECTRICITÉ MÉDICALE,
November 25th, 1904.

RADIO-ACTIVE COTTONWOOL.—A Russian physician, Dr. Londov, publishes an ingenious idea. He exposed some cottonwool to the emanations of radium and found that it became remarkably radio-active, which property it retained for a long time if kept in a hermetically sealed receptacle. Several milligrammes of radium are enough to prepare a large quantity of cottonwool. If cottonwool thus prepared is applied to the skin, an inflammation is produced as with radium itself, but the dosage can be much more easily regulated.

THE ZINC-MERCURY ELECTROLYTIC AND CATAPHORIC TREATMENT OF CANCER.—Amédée Pranger, in a paper read before the American Electrotherapeutic Association, considers (1) the nature of cancers; (2) the physics of the Zinc-Mercury Electrolytic and Cataphoric method; (3) the mode of action; and (4) presents a summary of cases. Of the 12 cases reported, three were operable, six inoperable, and three hopelessly inoperable. Of the operable all three recovered. Of the six inoperable, two were cured, two improved (one of the latter doing so well as to give promise of cure), one palliated and one failed. Of the three hopelessly inoperable, palliated one, failed one, and died one. Anatomically the disease affected the tongue in three, breast in two, neck in two, cervix uteri one, genitals one, face one, eyelid one, cranial bone one. Illustrations and photographs accompany the paper.—*Journal of Advanced Therapeutics*, October, 1904.

NOTICES OF BOOKS.

MEDICAL ELECTRICITY. By H. Lewis Jones, M.A., M.D., F.R.C.P. Revised and enlarged, with 12 plates and 168 illustrations. Demy 8vo. 4th edition. 12/6 nett. (London: H. K. Lewis.)

A fourth edition of this well known text book appears at a most opportune moment and is equalled in practical utility by few works and surpassed by none, for it contains all the good points of former editions, with many fresh ones added. In particular there is a full account of all appliances worked from electric light mains, which is in every way the best source of energy for efficiency, cheapness, and constancy of action. Of equal value is the description of X-ray coils, and everything connected with X-ray work, especially recent improvements. The chapter on high frequency apparatus will be acceptable both to users of this valuable therapeutic procedure, and to those who want up-to-date knowledge to enable them to advise on the best methods to recommend, when the treatment is entrusted to an expert medical electrician. It is a question whether in a future edition it would be advisable to omit the early part dealing with the physics connected with medical electricity. The time has passed when the teaching of physics, given in the student's first year, was mainly confined to heat and light, with but little notice taken of electricity, so that the practitioner's knowledge of the subject required supplementing when he undertook the care of patients on his own responsibility.

The judgment shown in selecting and preparing diagrams and illustrations is only equalled by the care devoted to the avoidance of errors and misprints as well as to preparing an excellent index. The present edition will be valuable to those who are familiar with former editions, and invaluable to those who are unacquainted with medical electricity.

* * *

ÉLECTRICITÉ MÉDICALE, by Dr. H. Guilleminot. (Paris: G. Steinheil.)

This handbook, entitled "The Work of the Laboratory of Prof. C. Bouchard," is divided into three parts. . . The first deals with the Physics of the various forms of electricity used in medicine. Useful suggestions are given as to the kinds of apparatus suited for operators under all circumstances, with practical hints for maintenance. The descriptions of instruments are on the whole good, but we think more should have been said on the construction of coils for faradism, especially with regard to interrupters. The same may be said on the question of skiagraphy by means of the induction coil, which is perhaps too much neglected in favour of the new Gaiffe and Villard apparatus; this latter, however, is very clearly described, and the author is of opinion that it almost entirely supersedes the older methods.

Part II. treats very ably of the physiological properties of electricity. An interesting *resumé* is given of the experiments of M. Leduc on the resistance of the human body; he finds

differences in conductibility to be due only very slightly to the presence or absence of moisture in the skin, but almost entirely to the degree of ionisation. By the two following experiments he proves that the vascularisation of the skin exerts little influence: The subject is included in a circuit in such a manner that one of the electrodes, consisting of a bath of 1 % saline solution at 50°, can be instantly replaced by a similar bath of the same solution at 0°; the conductibility of the system is then seen to be exactly the same (the surface of contact being the same in both cases), which proves that vaso-dilation due to heat does not modify the resistance. Again, a large cathode is taken, consisting of an electrode impregnated with solution of KCl, and a small anode impregnated with solution of adrenalin hydrochloride. Under the influence of the current the skin is blanched. The resistance should then increase; on the contrary, it rapidly diminishes.

An excellent chapter is that on the action of X-rays, in the course of which stress is laid on their power of destroying glycogen; experiments are given in proof of this fact. Another interesting chapter is that on ozonisation, in which operators are warned against remaining too long in a room in which the high frequency currents are being employed, on account of the action of ozone on the lungs.

The third, or medical portion, is well and systematically written. A clinical abstract is given of each disease, followed by "Electro-diagnosis" and then "Electro-therapeusis." Where skiagraphy is of assistance the method of operation is described and also the pathological appearance of the part as seen in the skiagram. We think, however, that not enough stress has been laid on the value of stereoscopy. The chapter on epilation is a good one, the selection of cases and mode of operation being more fully dealt with than is usual in a work of this nature. Dr. Guilleminot advises the use of a somewhat blunted needle, bent at an angle of 45° about 6 mm. from its point, as the angle both facilitates the introduction and indicates the depth to which the needle has entered the follicle.

We find also some interesting remarks on the treatment of general obesity: large electrodes are applied to the shoulders, abdomen, buttocks and loins, the negative electrodes being of slightly greater area than the positive. The continuous current is applied with intensity gradually increasing up to 150 milliampères. Daily applications are given lasting at first half an hour and later one hour. After about a week supplementary treatment is given, such as faradisation of the abdominal and other muscles, gymnastic exercises, etc. The author claims by this procedure to reduce the weight 8—15 kilos (about 17½—31 lbs.) in one month.

X-ray treatment of malignant growths is discussed at length. Dr. Guilleminot observes the following rules in carcinoma mammæ:

1. If it consists of non-ulcerating, operable growths, especially if the axillary glands are not involved, advise operation and treat afterwards to prevent recurrence.

2. If there is ulceration treat immediately, promising tempo-

rary cure of the ulceration, but with no guarantee against its recurrence. Use at first the less penetrating rays, giving two exposures weekly; when the skin has healed continue to treat with the more penetrating rays, in the hope of diminishing the tumour itself.

3. In the case of an inoperable recurrence treat with the more penetrating rays, warning the family of the slenderness of the chances of success. "Surprising results are, however, sometimes obtained, and, in view of the inutility of all other therapeutic measures, the duty of the physician is, even in those cases which are least favourable, to treat."

Last, but not least, the book has an excellent index.

* * *

LES RAYONS "N" ET LES RAYONS "N," by Dr. Bordier. (Paris: Baillière et Fils.)

This is an admirable little work in which all that is at present known on this subject is collected. In their application to medicine most of the researches have been made on the nervous centres; when it is wished to notice the emission of the N-rays by these centres the best means is to employ Broca's method, in which a screen of calcium sulphide is used. On passing this over the cranium the nervous centres, by emitting a larger number of N-rays, cause a more brilliant lighting up of the screen. Similarly a shadow is seen on passing the fissures—those of Sylvius and Rolando being easily marked out. In the spinal cord the points where the emission of N-rays is greatest are the second, fifth and eleventh dorsal, the second lumbar and the middle of the sacrum.

During anæsthesia it is noticed that these rays are emitted in great quantity in the period of excitability, in later stages diminishing gradually until they entirely cease.

It would appear that in the future these rays will prove of great assistance in the diagnosis of nervous lesions and probably also in other departments of medicine.

STERILE WATER ANÆSTHESIA IN THE OPERATIVE TREATMENT OF RECTAL DISEASE, WITH A SUMMARY OF 220 CASES.—Gant finds this method supersedes the use of cocain and even general anæsthesia. Anæsthesia is apparently produced by the mere pressure of the fluid on the nerve terminals in the tissues. Sufficient water should be introduced to thoroughly distend the tissues, causing them to become anæmic and to assume a glassy whitish appearance, when anæsthesia immediately follows. From 10 min. to half-a-dram of water only is required for small hæmorrhoidal tumours and from half-a-dram to four drams in more extensive operations. Gant employs this method of producing anæsthesia to the exclusion of all local medicinal anæsthetics, in nearly all of the operations upon the rectum, hæmorrhoids, fistula, fissures, etc., and with gratifying results.—*New York Med. Record*, Nov. 5th, 1904.

PART II.

PROCEEDINGS OF THE BRITISH ELECTROTHERAPEUTIC SOCIETY.

Edited by CHISHOLM WILLIAMS, F.R.C.S., Ed.

The Twenty-fifth Ordinary Meeting was held at 11, Chandos Street, Cavendish Square, W., on Friday, the 25th November, 1904. The President, Dr. LEWIS JONES, occupied the Chair.

Present:—21 members and one visitor.

The minutes of the Twenty-fourth Meeting were read and duly confirmed.

The ballot was then taken and proved unanimous in favour of the following gentlemen:—John Roberts, M.D., 8, Abbey Square, Chester; Robert Fenner, M.R.C.S., 36, Harley Street, W.; Edward Tait Robinson, M.D., 21, Gloucester Place, W.; Jean Gandil, M.D., 6, Avenue Masséna, Nice; Victor John Blake, M.B., Elsinore, Ventnor; William Jones Greer, F.R.C.S., Newport, Mon; John Curtiss Webb, M.B., 24, Bina Gardens, Kensington; Robert Douglas Dobie, M.D., 110, Strand, W.C.; William Anderson, M.D., 1, Foulis Terrace, Onslow Square; Samuel Macfarlane Sloan, M.B., Ch.B., 130, Hyndland Road, Glasgow, W.; Richard Higham Cooper, L.S.A., 11, Welbeck Street, W.; John S. Griffiths, M.R.C.S., Redland's Park House, Bristol.

Dr. DONALD BAYNES then read a short paper on "Present Position and Future Prospects of Electrotherapeutics in Great Britain."

Mr. President and Gentlemen,—I crave your courteous attention, but for a very few minutes, to a subject which is of vital importance, not only to ourselves but also to the unfortunate Public, who are at present being freely experimented upon by a lot of ignorant and unscrupulous vampires. I hope to get a frank expression of opinion on the subject from the members here present. The subject is that of Electrotherapeutics: its Present Position and its Future Prospects, and also its relation to the Profession and Public.

Now there are two natural laws or axioms, which are as certain and as true as that the sun rises in the East and sets in the West; to which we will do well to give earnest heed, and to act upon.

First.—Knowing, as we do, that life is one constant fight against aggression, is the following: *self-preservation* is the first law of nature;

Second.—Nothing in this world is, or can be, stationary; everything must advance or retrograde; we must go forward or go back.

The history of nations and great political movements bears witness to this fact.

With these as my texts I will now proceed with my sermon.

It will be within your recollection that at the meeting of the B.M.A. at Swansea, we had a sub-section in the section on Medicine.

Our meetings were most successful. They attracted many members from other sections, and were well attended, not only by our own members but also by many of the members of the B.M.A. In fact, in point of numbers, we were not far behind those of the principal sections, and equal to, if not greater, than any other sub-section.

At the Oxford Meeting (last July) unfortunately we did not get a sub-section, although we had room and held a meeting. Now why was this? What the cause? I may give two reasons: 1st, our own apathy; 2nd, to the influence of certain members on the Council, who viewed our success at Swansea with displeasure, and who are determined, if possible, to kill our endeavour to place electrotherapy in the position it rightly holds in the field of therapeutics.

The question now arises: Are we prepared to acquiesce in this state of things? Are we prepared to meekly bow our heads and accept any little crust these gentlemen are willing to throw to us—such as the use of a room (as at Oxford), etc. Are we, in fact, to accept this contumelious position "lying down"—as it is termed? If so, we may as well furl our banner at once; as in this position we must retrograde and our banner will be furled for us, or rather it will be torn and trampled under foot. Or will we, like the proverbial worm, turn, and fight the battle out?

If I may judge from the feelings of many with whom I have conversed and consulted on this matter, we are prepared to close our ranks and fight this question to the bitter end, and if we fight manfully, even at some personal inconvenience, the victory is ours.

Our plan of campaign must be at once carefully considered, and when considered and settled must be steadily and persistently carried out.

I will now offer the following suggestions for our programme. I hope they will be thoroughly criticised, amended, deleted, or otherwise dealt with as you may decide. I also hope the members here present will put in writing their views and suggestions, we might then have a special meeting and decide on our line of action.

Simply meeting here, once a month, to listen to papers, etc., is no doubt useful and instructive—but it does not

advance the status of electrotherapeutics, and the movement we have initiated must die out, in accordance with the law I have mentioned, unless we are prepared, not only to act on the defensive, but boldly carry our war into the enemy's camp. I quite know that this will mean a certain amount of personal inconvenience and probably a certain amount of misrepresentation—still, if we are to win, this must be faced and met.

My suggestions are as follows :—

1. Organise a special political committee, to co-operate with that of the B.M.A.

2. As far as possible, we ought to attend all meetings of the B.M.A., as by this means we will become known to, and know the active members of the Association, and harmoniously work for our mutual interests.

3. Medical men who employ unqualified persons to do their electrical work, might be called upon, or written to by our Secretary ; pointing out that by so doing, they not only injure their professional brethren who have taken up electrotherapeutics as a speciality ; but also that they are not doing justice to their patients when they place them in the hands of persons who have had no medical training and possess little, if any, medical or surgical knowledge. We have, for example, chemists, engineers, lawyers, Turkish bath attendants, cab proprietors, valets, ladies of various kinds, and last, though not least, large municipal corporations, all acting as medical practitioners. That much needless pain, suffering, and even permanent injury has been caused by these persons, our consulting rooms can amply testify. If a tithe of the actions (which are wisely settled out of court) came on for trial, the practice of these individuals would soon come to an end.

4. The instrument makers, chemists and such-like, whom we help to support by our custom, must be taught that when they leave their legitimate business and encroach on our professional ground, that they need not be surprised if our custom goes elsewhere.

5. To keep pegging away at the councils of the B.M.A. and Med. Defence Unions, drawing attention to the fact that covering in any shape is illegal, as also is the employing of unqualified assistants. Now, may I ask—Can anyone deny that the employment of unqualified assistants to stay in a surgery of a medical man and pay an occasional visit, always under the Principal's eye, is not a far less evil than putting a patient in the hands of unscrupulous, unqualified, and ignorant persons to carry out a treatment that requires medical and surgical, as well as technical, skill? But who, unlike the unqualified assistant, is not under the direction or supervision of the medical man. Now I ask you, can anything be more derogatory to the profession

than such a condition of things as now exists? Imagine a member of one of the learned professions accepting and endorsing the treatment advised by individuals who have failed in the various occupations in which they were brought up, and who *now* pose as medical electricians, though their only knowledge of electricity consists in being able to turn the switch of a high frequency machine. I may mention one case where a medical man sends an unfortunate lady to the local chemist for electrical applications to her womb. Imagine uterine metallic electrolysis being carried out by persons who have not and never had any medical training! Can absurdity go further? Yet such cases occur. The laws against covering and employing unqualified assistants are relentlessly enforced where an unfortunate country Doctor is concerned, but in our large cities, and towns, we have the edifying spectacle of some leaders of the profession openly covering, and employing unqualified men. It is truly said one man may steal a horse, while another is punished for looking through a hedge.

6. Correspondence on electrical subjects should be initiated and carried on in the various medical journals.

7. When opportunity occurs, papers should be read in the various medical societies to which any of us may belong. These two last suggestions are among the best ways of extending a knowledge of electricity among the rank and file of the profession.

8, and lastly.—To more fully educate the profession and to make our influence felt there might be a hospital, or clinic, or school of physical therapeutics, such as has been so successful in the United States. Unless this can be done (and I am only echoing the valuable remarks of Mr. Edmund Owen at our first annual meeting) we will not make any great advance, nor can we place our speciality in the position it should occupy.

Remarks.

Dr. Graham said: The subject of Dr. Baynes' paper is of the greatest importance both to the general public and to the medical profession, more especially to those members of it who interest themselves almost exclusively with electro-therapeutical work. There are few of us, I am confident, who have not seen some lamentable results as a consequence of treatment given by unqualified persons of the class described by Dr. Baynes. Even in a recent case tried in the Law Courts, where damages for injury were given against a medical man, it appeared from the publisher's evidence that he had subjected the obvious duty of treating his patient himself to an unqualified person. It is a subject surrounded with difficulties, as Dr. Batten has well shown.

Of the various means mentioned by Dr. Baynes for combating the evil education seems the best, but it must be the education of the rising generation of medical students. Many of the senior members of the hospital staffs take, I fear, little interest in the matter.

The proposal to establish a Central Electrotherapeutical Institution in London would have little educational value. Consequently the principal centres to which our efforts should be directed are the hospitals that have a medical school attached. It is on the junior staffs, tutors, and demonstrators of these hospitals that we must depend to place this department of medicine in the high position it should hold. Where opportunity offers students should be induced to enter only those hospitals having good electrotherapeutical installations where proper instruction on the subject can be received.

Dr. J. B. BATTEN thanked Dr. Donald Baynes for his paper and valuable suggestions which should certainly be acted upon. He thought the whole matter was exceedingly difficult, because it was so hard to draw the line where treatment by non-medical persons was to begin or end. Unless medical men were prepared to do all massage cases, therapeutic baths, etc., themselves, it would be difficult to prevent laymen and nurses doing Nauheim baths, high frequency and X-ray works. Also if the bucket-shops were only those like the one Dr. Baynes mentioned as run by an ex-valet, it might be easier, but when municipal bucket-shops were run in such places as Bath, Harrogate, Buxton, and where they were supported by practically all the local medical faculty, it made the matter much more difficult, and the profession and public would take a long time learning what was the truth.

Dr. A. LANE complimented Dr. D. Baynes on paper read. In reference to Black List suggested was afraid it would be a very long one. What can one think when throughout England many gentlemen holding high positions on hospital staffs send therapeutic work to laymen, or, to use a strong word, "quacks." The example set to their juniors, more particularly students, is a very bad one when we consider that they cannot call this upholding professional dignity. What constitutes covering? Unqualified assistants formerly were supervised, now any medical man possessing one is liable to have his name removed from the Register. Therapeutic work often of a very delicate nature is done by these men, who are not supervised, and whose professional knowledge, and often electrical also, is next to nil. Look at many of their antecedents. Why should "Medical Electrician" be assumed by these men, while, if an unqualified man presumes to be a dentist, placing "Surgeon" before "Dentist," he is promptly held up and heavily fined. Those gentlemen who are in private practice, and also use this treatment, had

better remain as they are ; to specialise in electrotherapeutics only is a sorry game as far as professional support is concerned. The quack who settles down close by has the support, not you. Now this cannot be denied, the only question is how to stop it. It would be advisable to appeal to the General Medical Council to know what they mean by covering in a professional aspect. If a man who specialises, and who doesn't in any way interfere with the general part of a practitioner's practice—in fact, behaving honourably, cannot obtain the support of his professional brethren, it is a poor look out for so-called professional etiquette. He gave some examples of difficult bone cases where professional knowledge was absolutely necessary for diagnosis from nerve lesions. On the whole Dr. Baynes' paper was an excellent example of how hard a fight is in front of us, to make even small headway. He suggested occasional meetings in large country centres, so that the cause of the Society may be forwarded by inviting the local medical men to attend the meetings.

Dr. GAMLEN said: I agree with most of Dr. Baynes' paper and the remarks made thereon by Dr. Lane. I think some steps ought to be taken to rectify the false position assigned to medical men who use electrical methods as a means of treatment.

In the North and especially in Newcastle-on-Tyne most of the electrotherapeutic work is done by firms or chemists. This might be excusable were there no competent medical men at hand. Some members of the teaching staff, together with many of the leading physicians and surgeons, send their cases to chemists, whilst other medical men go a step further than this and use all arguments at their command to bring any and all forms of electrical treatment into discredit by picturing to their patients all the evils which might ensue under certain circumstances and at the same time denying that any advantages can be derived from this form of treatment under any conditions whatever.

The President, Dr. LEWIS JONES, said that the main reason for the commonness of unqualified practice was the absence of any penal clauses in the existing Medical Act. As members were aware, it was proposed to amend this Act, and among the alterations certain penal clauses were foreshadowed. It would therefore eventually depend upon the Legislature of this country whether penal clauses would hereafter be embodied in an amended Medical Act.

Dr. GAMLEN read a paper on "The Treatment of some Skin Diseases by X-Rays, H.F.C., Finsen, and other Light Rays," which was illustrated by many interesting lantern slides.

Owing to the discoveries made by Finsen, d'Arsonval, Madame Curie and others, new means have been found to

combat many forms of skin diseases, and some of these have given excellent results.

These methods are still in their infancy, but new investigators are entering into the field of research, and so gradually increasing experience will improve our methods.

I have had, within the last five years, favourable opportunities of testing some of these methods of treatment, and of comparing the results obtained with those of other observers.

On referring to the material which I have been collecting it became evident that all could not be concentrated within the scope of this paper; some points must therefore be lightly, and I fear imperfectly, treated upon, but I hope that the discussion which follows may open up new ideas and elicit the experiences of the members present.

The main feature of my paper is the record of cases in which I have personally applied the X-rays.

My experience with the ultra-violet rays (St. Bartholomew's lamp) is much less extensive than with the X-rays, but such as it is I will in brief submit to you.

With regard to the merits of the Finsen lamp, I have had many personal opportunities of testing these as compared with the X-rays; and this was assisted by what I saw and learned of the Finsen light treatment during a short visit to the Finsen Institute at Copenhagen.

I hope to indicate when, and to what extent, it may be possible to determine which might be the better method in any particular case. I have ventured to lay down rules of procedure which may be applied in every day practice, but I make no claim to originality beyond what is the outcome of my own successes and failures, and if at times I seem to differ in my methods, and to have had results differing from those recorded by other workers, it is simply that I have not always gone on beaten tracks, but have acted as gradually growing experience has dictated.

Limelight views will illustrate many of the cases before, during, and after conclusion of treatment, and I hope some of them will bring prominently before you the merits of some forms of treatment in preference to others. My endeavour from the outset has been to regard this subject from the standpoint of the experimentalist, and in that spirit to as unhesitatingly record my failures as my successes.

Treatment by X-Rays.

I have found X-ray treatment more or less effective in the following skin ailments:—

(*a*) Lupus Vulgaris and Erythermatosus.
(*b*) Eczema: acute, chronic and parasitic.
(*c*) Psoriasis.

(*d*) Acne.
(*e*) Ringworm.
(*f*) Keliod and chronic ulcers of various kinds.
(*g*) Prurigo.
(*h*) Nævus.
(*i*) Hypertrichosis.
(*j*) Rodent ulcer.

and (*k*) As regards superficial epithelioma, I will indicate some of the cases treated in this way, and how my views as to its application had to be modified according to the results obtained as time went on.

The Treatment of Lupus Vulgaris by X-Rays.

It is notorious in the experience of surgeons that treatment of this disease by operation is only too frequently followed by early recurrence.

Altogether, I have successfully treated over fifty cases of lupus vulgaris by means of X-rays and light treatment. In some instances at least, knife and curette had been already used freely, and in one case the unfortunate patient had been submitted to nearly one hundred operations, and although healthy skin had been grafted on to the portions so treated, the result was far from satisfactory, and could only be regarded as of a temporary nature.

X-ray treatment not only does away with the necessity for operation, but in the event of the knife having been already used, the power and penetration of the rays seem to eradicate most of the traces and disfigurements of operation. After the healing process has been completed the X-rays leave a soft, pliable scar devoid of many of the contractions. On the ground of appearance alone therefore the superiority of the X-rays over the knife must be recognised, while the risks attending the use of an anæsthetic are obviated. There is not the least shock to the system, and the whole course of treatment is absolutely devoid of pain and inconvenience. Patients may faithfully fulfil the requirements of their medical man, and at the same time may be often able to follow their ordinary avocations. A periodical and painless X-ray sitting lasting a few minutes does not in any way aggravate the appearance of the disease, for the slight effects which ensue in the form of reaction are merely local in extent and temporary in duration.

It is essential that these striking advantages of X-ray treatment should become widely known. Operation has become so intimately associated with the cure of lupus in the public mind that many sufferers fearing such an ordeal, hesitate; time is lost, and the disease spreads and becomes more difficult to cope with. I have no hesitation in asserting

that when operation fails, or is refused, the X-rays and light treatment will succeed, and that this treatment has been sufficiently tried and proved to establish its recognition as the primary and only effective way of dealing with lupus.

I have come to the conclusion that caustics such as pyrogallic acid, etc., used by some authorities, are unnecessary and may account for some excess of scar tissue.

Not a single case of lupus vulgaris, no matter how deeply seated, has come under my notice, which could not be treated without accessory applications.

Once only I had difficulty in carrying on the treatment to a satisfactory issue by X-rays. In this instance, the disease and scar tissue were in such a sensitive condition that the shortest application of the rays, either with low or high vacuum tubes, brought on a severe, painful reaction, which lasted several weeks.

In the treatment by X-rays, consideration must be given to the condition of the vacuum of the tube; tubes high in vacuum being less effective than those low in vacuum, though if high vacuum tubes are worked with more current, and on a larger coil, they may for the time being be transformed into tubes low in vacuum. If time is no object, and the operator a beginner, the use of high vacuum tubes which require longer applications is the better and safer plan. The use of low vacuum tubes is much briefer and, I believe, in the long run, more effective; but we must remember that if their use is not carefully studied and noted, the treatment may be too vigorous, and painful results may occur.

Special care must be taken of tubes low in vacuum, especially when on working there is found to be much blueness behind the anode, or between the anode and cathode. A tube which is reversing is particularly deceptive, as though low in vacuum the secondary may jump a large alternate spark gap, thus giving the appearance of being high in vacuum. This generally happens in badly exhausted tubes, or when working with mercury motors; the mercury and spirit become dirty, thus not allowing a good break in the primary circuit.

On first commencing this treatment I found what I then thought to be idiosyncrasies in my patients, but on making more careful observations by studying my instruments and the results obtained from them, I found most of the supposed idiosyncrasies were due to defective conditions of apparatus and want of experience on my own part.

I share the belief that in X-rays we have obtained a specific for lupus. In the event of a return of the disease, it indicates to me that the mischief has not been thoroughly eradicated—that though apparently cured, there yet remained undetected foci of disease.

Acting on this assumption, I make it a general rule after apparent cure to give several further prolonged sittings, but using tubes higher in vacuum than in the earlier sittings, with the idea of affecting the deeper layers of the skin. Applications given in this way every second week will allow the reaction of the previous application to have almost died away before proceeding to produce another reaction.

Several of my first batch of cases returned to me showing slight recurrence of the malady. I have, however, had many cases which showed no return of the mischief after a period of three years.

Some workers do not advocate the production of the slightest dermatitis, considering it not only unnecessary but as having a tendency to retard the cure. They always use high vacuum tubes at a good distance from the subject, and stop radiation on the slightest sign of reaction. On the other hand, some go to the opposite extreme, and purposely create very severe reactions, so as to cause the whole seat of application to break down into an ulcer. This is very painful and takes weeks to heal. With regard to the first mode of application, *i.e.*, the so-called non-reaction method, I have, in those cases which I have had opportunities of seeing under treatment noticed at the seat of application decided signs of a mild dermatitis.

In my own work I have on several occasions, generally accidentally, caused so severe a reaction as to bring about ulceration. This method of treatment I am inclined to think is wrong, from the fact that cures can be brought about without its use, and that the pain is so severe that there is a strong probability that the patient may not return for further treatment. I am thus at variance with the practice advocated by some writers, of giving daily sittings lasting from ten minutes to half an hour. It has always been my object, by using low tubes, to obtain an appreciable result only as rapidly as is consistent with safe treatment, and I almost invariably give sittings two or three times a week, lasting from five to eight minutes.

When beginning the treatment it is impossible to exercise too much discretion. At the outset, as already stated, I always use a low tube because of its more rapid action, and for the first few sittings carefully watch the effect, as I consider it essential to set up early a mild reaction and steadily maintain it. Such, in my opinion, is the surest and most speedy method consistent with safety. It may be necessary in order to create reaction to use exceptionally low tubes, but this is a matter purely of judgment and personal observation. Once having found a tube to suit a particular case the duration of up-keep of the reaction must depend mainly upon the following points :—

(*a*) The interval between and length of sittings.
(*b*) The distance between the patient and the target.
(*c*) The wattage of the current used.
(*d*) The individual necessities and constitution of the person under treatment.

The dermatitis produced may at times be more severe than necessary and so necessitate suspension of treatment for some little time. The experience thus gained, however, will enable one the better to judge what should be the duration of subsequent exposures.

As I am in a position to describe the treatment of lupus more fully than that of other disease, it would be well to affirm some principles which are generally applicable, and at the same time to combat some erroneous assertions which I cannot support by my own experience.

By the casual observer cases of lupus in which there is a large amount of inflammatory swelling with points of suppuration are apt to be regarded as of such a severe nature as to require an extension of the usual period of sitting. On the contrary, few sittings should be given to such cases in order to create a fairly severe reaction. When this reaction disappears the parts usually skin over and the swelling subsides. On minute examination a few remaining lupus nodules may be revealed, which should then be treated in the ordinary way. The whole treatment, however, is comparatively brief and remarkably effective. It is in the cases which show scar tissue, with here and there a nodule under the skin, that a long course of exposure is required. A cure will be more speedily effected by the adoption of a simple plan of attack. The peripheral growing nodules should be regarded as the principal source of trouble. After these have been subjected to some rigorous treatment it will be found that the more centrally situated and less active nodules have disappeared. The leucocytosis created is in itself sufficient to exterminate the central nodules, whilst should the treatment be concentrated here alone the leucocytosis will be ineffective in dealing with the peripheral nodules. Sometimes it would seem that the growth of the peripheral nodules is temporarily stimulated, and it is then only by the adoption of longer sittings to the parts in question that the temporary increase of the growth can be arrested and ultimate cure effected.

I have carried on X-ray treatment in various ways, and I find that though short sittings at judicious intervals will safely and surely give the results required, yet a better plan, especially from the patient's point of view, is to give sittings once or twice a week (sometimes not even so often) of twenty minutes' exposure, and this will, as a rule, give a moderate reaction within four days, which commences to abate about the fifth to the sixth day. Another twenty minutes on the

seventh to ninth day will keep the reaction to the standard required. A little longer or shorter exposure at each sitting can be given as required. This method has a great advantage, especially when the patient has to come long distances for treatment. In the treatment of those cases of lupus affecting such parts as the nasal cavity, pharynx and larynx, parts which are deemed by some authorities inaccessible to thorough treatment, but which I have apparently brought to a successful issue, I use tubes much higher in vacuum than in superficial cases; but, in order to enable the rays from such tubes to efficiently reach these deeply situated parts an amount of superficial radiation is incidentally produced, which would not be desirable were the superficies being actually dealt with.

Treatment of Lupus by Light Methods Alone and Combined with the Use of X-Rays.

Having thus rapidly indicated to you my method of dealing with lupus by X-rays, I will now attempt to give my experience of phototherapy in treating the same disease, *i.e.*, the use of the Finsen lamp and the ultra-violet ray lamp, St. Bartholomew's Hospital pattern. I would like to emphasize the fact that despite the more lengthened sittings and the longer duration of treatment required by these means, yet the results show that the extra trouble is not misspent.

I have been using the Finsen lamp for about a year, and during that time have had sufficient opportunity in my practice to enable me to express my appreciation of the usefulness of this form of treating lupus.

The action of the Finsen light creates an inflammation of the skin, slight in most instances and without pain, although a ringed blister generally occurs. After each application the part is covered with zinc and lanoline ointment on a pad. In exceptional cases considerable pain is caused, but the punctilious attention to detail usually prevents this. Two to three applications may be necessary to clear up each lupus nodule according to the depth of its situation, the intervals between each application being from seven to ten days. In common with some other workers I have endeavoured to improve upon the results obtained at the Finsen Institute by having some of the positive carbons loaded with iron, cadmium, silver and aluminium, as these metals are well known to give off a much larger number of ultra-violet rays than does carbon alone.

By these methods, in comparison with the use of carbon alone, I find a much greater reaction takes place with the same length of sitting, and it is my opinion that by these methods for strictly superficial lesions greater benefit is

derived. In the event of the nodules being deeply seated, however, the use of these compound carbons is inferior to that of the pure carbons, since to bring about a final result in such deep seated nodules a greater number of sittings have to be given. The conclusion I draw is that the light from pure carbon has deeper penetrating power than from compound ones.

Several months ago I tried the effect of sensitizing the tissue under treatment by local injections of 1,000 erythrosine solution, and internally by large doses of quinine. I have now discontinued this accessory treatment, as I sometimes found the resulting reaction after the light had been applied so great as to cause necrosis of the skin in the area of application, sensitiveness was always increased, and on one occasion it was so great that the light could not be applied. The continuance of this treatment would have a tendency to form scar tissue, and the cosmetic advantages of the Finsen treatment would thus be lost.

In Finsen lamp work the individuality of the nurse is of great moment.

Firm pressure of the quartz lenses on the diseased part is one of the main elements in the success of treatment; another is focussing the light just beyond or short of the part under application and at right angles to the cone of light, so as to give a small ringed beam of light upon the surface. Attention or inattention to these details may explain the different results obtained by different workers with the lamp.

Time is saved in the treatment of deeply seated nodules by giving two-hour sittings to each individual nodule, as in some cases this sitting is sufficient to remove a nodule, whilst if the sittings only last a single hour several have to be given before the nodule disappears. It is also an advantage (especially in obstinate cases) not to wait until all the reaction that results from a sitting has disappeared, but to again give a lengthened sitting directly the first reaction begins to fade away. This may be from the fifth to seventh day after.

If, whilst the parts are under X-ray reaction they are treated with the Finsen lamp, the reaction is much more severe, and it is surprising how quickly some of the obstinate nodules clear up by such dealing.

After removing some of the nodules on the growing edge of a lupus patch, some of the parts nearer the centre may be found to have also healed without treatment directly applied, especially if such parts are superficially situated.

Here I think it will not be out of place to make some comparisons between Phototherapy and Radiotherapy. I consider each has its own special sphere of usefulness, but I consider that the best results are generally obtained by a combination of treatment.

When the disease is extensive, especially when there is ulceration and scabbing, together with much scarring, it is a great saving of time to treat the part first with the X-rays. A few applications judiciously applied will clean and heal the ulceration and banish a large number of superficial nodules. During these applications, especially when the reaction is at its height, the use of the Finsen lamp to individual nodules will hasten the result. In the event of the disease not being extensive I use the Finsen lamp alone, as there is no doubt that the cosmetic appearance after the Finsen lamp is slightly better than that of the X-rays alone. On the other hand, X-ray treatment is cheaper and does not require so much time for application. It is less painful under most circumstances, but by the slightest carelessness the after results may be much more painful than by the Finsen treatment. On the other hand, we must remember, under X-ray application we sometimes get obstinate tanning of the skin and atrophy of the subcutaneous elements leading to wrinkles.

Tangielectasis has also been mentioned by some writers as a drawback to X-ray treatment, but I believe this is generally due to strong caustics used as accessory treatment, as in my cases it has been an unknown element.

Finally, where time and money are no object, I think the Finsen treatment has advantages over every other known method.

Ultra-Violet Ray Method. Type: St. Bartholomew's Lamp. Its Use in some Skin Diseases.

So far as my experience goes, I believe the ultra-violet rays are very efficacious in the treatment of many ailments.

Here we introduce a process which eliminates the majority of the heat rays and allow the ultra-violet rays, which are the essence of the treatment, to exercise their powerful bactericidal influence. I have applied this treatment to several cases of—

(1) Lupus vulgaris.
(2) Lupus erythermatosus.
(3) Alopecia areata.
(4) Rodent ulcer.
(5) Parasitic eczema.
(6) Keloid, etc.

I have already in the official journal placed before the members the means I employ to bring about a favourable result.

The main features in the successful application of the ultra-violet ray lamp are—

(1) Firm pressure.
(2) The use of ice block compressors.

(3) Bringing the light as near as possible to the treated surface.

Provided the rays are not too excessively intense, healthy tissue resist their influence, while the lowly organized or diseased tissues are liable to succumb to their power. For this reason the rays have a general effect upon healthy tissue, but a selective one when they come in contact with the lowly organized diseased tissues.

From photographic experiments I have demonstrated that alone these rays do not possess powerful penetration. Experiments personally conducted with electrodes formed of various metals such as cadmium, silver, iron and aluminium, gave me slight differences in reaction and results, but they were not carried out sufficiently long to make one positive which metal gave the best results, but I still rely on the iron electrodes.

Lupus Vulgaris.

Dr. Malcolm Morris and Dr. E. Dore in the April (1903) issue of the *Practitioner* maintain that the effect of the ultra-violet rays is too superficial to be of use in a deeply seated disease like lupus. That at least is not my experience. The solitary objection which can be urged against the lamp is the peculiar noise emitted, but considering the advantages derivable, that need not be a deterrent to the use of this form of treatment.

I regard it as an instrument which possesses great curative capabilities, but these can only be obtained by supervision, judgment and patience. Want of success in many instances is due to the relegation of the work to assistants who may lack that personal interest so essential in such work, and that is an observation based upon the experience of one who has had the opportunity of witnessing the methods peculiarly the assistants' own.

In giving an opinion as to the probable duration of treatment necesssary to effect a cure, the amount of scar tissue must be reckoned with. This scar tissue having a larger amount of fibrous elements than normal is less highly organised and therefore more difficult to react upon, with the result that treatment must be prolonged.

When first beginning treatment I regarded ten minutes as a standard limit of length of application to each diseased part. Several failures, however, persuaded me to increase the period. Now I administer exposures lasting fifteen to twenty minutes, and the result of this is certainly more effective.

In non-ulcerative cases it is sometimes necessary to create an ulcer over the seat of the disease. That can always be accomplished by prolonged sittings.

I have found dark-skinned people more obstinate of cure than light-coloured people. The pigmentation of the skin is evidently the cause. Non-ulcerated nodules are more obstinate than ulcerated ones, and this particularly applies to scar tissue. The after treatment is similar to that in using the Finsen lamp. The final result when obtained is equal to that from the use of the Finsen light.

I do not recommend the ultra-violet ray lamp in preference to other treatment, as its effect upon deeply seated nodules is very slow, but for some ordinary cases of lupus it is most effective. To prove this I successfully experimented upon two very obstinate cases which had previously been treated at two London hospitals unsuccessfully. In one the lupus was on the right cheek, the nodules being in dense scar tissue and feeling like large shot corns when felt from the inside of the mouth. Yet they were all successfully removed twelve months ago, and as yet there has been no return. I will afterwards on the screen show you several cases treated in this way successfully. The treatment certainly was slow but very effective.

Lupus Erythermatosus.

With regard to the treatment of this ailment I have not had the same amount of success as in lupus vulgaris, and I have had fewer cases to deal with. One of them which I had apparently cured returned five months afterwards showing slight recurrence. I again treated this in the same way, though I now gave much longer applications. A year has now elapsed, and as yet there has been no further recurrence.

I shall show you on the screen another obstinate case which entirely resisted this treatment. High frequency applications also proved ineffectual, but it showed improvement under X-rays. It, however, was not carried on to a favourable issue.

I have now discarded this treatment for lupus erythermatosus as I can get much speedier results with the Finsen light and the X-rays, the latter being the quicker and on the whole more effective method.

Alopecia Areata.

I have treated three cases of Alopecia with the St. Bartholomew's lamp. Two of them were successful, and have shown no return of the ailment. The third patient gave up treatment before completion, and I have lost trace of him, but it did not seem to respond as did the others.

I gave twenty minutes' applications every fifth day. After each part had had two to three applications, hair

commenced to grow, light in colour at first but growing darker as time went on. To some of these places I had to give a further application before I was successful.

I am not aware if there are any recorded successes in the treatment of this ailment by these means.

Rodent Ulcer.

On several occasions I have tried the effect of the ultra-violet ray lamp upon rodent ulcer. In all of them I was successful. The result of two of them will afterwards be shown upon the screen.

Again, I have not noticed recorded success by other workers. I do not recommend its use, however, as much quicker results may be obtained by the X-rays.

Keloid.—I have also been successful with some slight keloids, but again X-rays I find to be the best treatment.

Ringworm, on the scalp and face, I have also cured by the use of this lamp, but the process is too tedious to be recommended. X-rays again I find to be the most sure and effective treatment.

The Treatment of Eczema by X-Rays.

From the results of my experience in the treatment of eczema, acute, chronic and parasitic, I am inclined to the belief that all these varieties, no matter how intractable or of how long standing, can be entirely eradicated within a period of three months' treatment.

Up to the present time I have treated ten cases of chronic eczema, four of acute eczema, and four of parasitic eczema, and have had favourable results in all of them.

With reference to parasitic eczema, which is particularly intractable to ordinary local treatment, the efficiency of X-rays is very marked. The time in which this form of the disease can be eradicated may often be less than a month's treatment, and treatment in this way has never taken longer than two months; even this time may be hastened if necessary, but I do not consider it advisable to unduly hasten recovery, as the reaction thus caused may be so unsightly as to keep the patient indoors.

The majority of cases of eczema which I have treated were brought for X-ray applications as a last resource, after all recognised forms of treatment had been tried. Of the cases treated there has not been as yet a single failure. It may also be stated that most of the cases have remained cured for such a length of time as would incline one to regard the cure as permanent, as up to the present moment all the parts formerly diseased (with one exception) appear perfectly

normal. One case did relapse after remaining apparently cured for eight months. The slight recurrence was removed after four further sittings, and though seven months have elapsed, there has been no further return.

The results may be obtained by any practitioner who possesses the necessary apparatus, and a few observations may make the treatment easy of administration. I always use low vacuum tubes, and I cause a fairly severe reaction, which generally takes place after four or five sittings have been given. At first the intolerable itching disappears, but otherwise the part under treatment appears to be worse, as a result of the reaction caused; but after this reaction has disappeared it will be noticed that most of the eczema has also gone. Treatment is again carried on in the same way until on the cessation of the reaction no sign of the eczema remains.

In obstinate cases I give a few further applications even after no trace of the ailment remains, and the more inveterate the case is, the further do I carry on the dermatitis. I have not as yet ever found it necessary to cause ulceration. The slight cases are cured after causing a slight reaction on two or three occasions, but such mild measures are of no permanent benefit in chronic cases, especially eczema sycosis and ringworm of scalp.

It is sometimes surprising how quickly some cases improve, cases which have obstinately baffled ordinary treatment for several years. I am inclined to be dogmatic in the opinion that no case of eczema, however long standing, need now be regarded altogether as hopeless until radiotherapy has been tried. And it is these obstinate cases, and especially dry scaly eczema, having been treated unsuccessfully by other means, which show the curative possibility of X-ray treatment. It is only after other means have failed that I would recommend this treatment. I use no accessory applications, and the parts must not be moistened with water as this intensifies the dermatitis, gives pain and delays the cure.

I may mention that for about three years I was myself afflicted with dry eczema affecting the perineal region and neighbouring parts, and under the advice of skin specialists I obtained temporary relief by the use of recognised applications, but no permanent cure. Eventually I was able to find an X-ray tube which promised the necessary reaction, and by perseverance effected a complete cure in about six weeks.

Other workers have obtained favourable results in the same way, but from the large number of recurrences, particularly as many of them use high vacuum tubes and stop treatment on the slightest indication of reaction, I am inclined to the belief that they were indifferently dosed, and

would venture to remind them that obstinate complaints require proportionately drastic measures.

The Treatment of Psoriasis by X-Rays.

All manifestations of psoriasis, no matter how severe, can be entirely eradicated by X-ray treatment. After the first few applications the silvery plaques become detached along with exfoliation of the surrounding healthy epidermis. The raised red bases and patches then gradually fade into the surrounding skin, and become normal in appearance, the staining which indicates the site of the disease remaines for sometime afterwards, and then it also disappears. A few further applications is all that is required in mild cases, but in chronic and severe cases I would strongly advise somewhat severer measures, and carry on the reaction until a decided dermatitis resulted. In one of my cases I unintentionally caused a slight burn over an extensive area, which, however, does not now show over these parts any return of the mischief; other parts which escaped this severe dermatitis have shown some slight recurrence.

As some observers report relapses to be the rule after treatment, and that they cause little or no reaction, it is significant that they have not pushed the treatment sufficiently far enough.

One of the cases which I have treated was a member of the medical profession, and all the affected parts exposed to X-rays disappeared in a remarkable manner. The patient referred to had been subjected to attacks of psoriasis every year for 19 years, the disease being for the most part confluent and almost universal. He knew that whenever the disease appeared he must retire from his work to a place where he could obtain quietude and careful nursing. During the early stage of the last attack I administered strong dosages of X-rays, and at the same time giving high frequency current with the result that—to use the patient's own words—the prolonged attack which from his former experience appeared to be inevitable, was staved off, without the messy ointment treatment which had previously been used and without arsenic.

Low vacuum tubes were used, and sittings lasting a quarter of an hour each given every second or third day. When the all-important reaction has been created the sittings may be lengthened or shortened according to the particular requirements of the case. I have, however, not had many opportunities of carrying this treatment on, and cannot say whether the influence of the rays will permanently cure the complaint. In the event of recurrence a few applications will most probably again so act on the disease as to remove it.

X-Rays in the Treatment of Hairy Moles and other Birth Marks.

Apart from the treatment of these disfigurements by electrolysis I have had greater success in treating them by the X-rays, and especially is this an advantage when treating an infant, as it can be made to cover a large area, and there is a minimum of pain. Low tubes are again most useful, a reaction being carried on until weeping dermatitis occurs. When this reaction has subsided the birth mark assumes a lighter colour. Each additional application will make the disfigurement less prominent, and this diminution generally continues until there is in some cases very little difference between the original mark and the surrounding healthy skin. I believe this change is brought about by a gradual permanent contraction of the blood vessels supplying the part.

Treatment of Rodent Ulcer by X-Rays.

I think it will be granted that the majority of cases of rodent ulcer treated by operation or caustics recur within a short period, but the X-ray treatment has proved most effective, and can be administered in sittings lasting only a few minutes, without accompanying pain or inconvenience to the patient. As a rule a cure can be effected by weekly applications.

After the first few applications the fœtid discharge, crusts and decomposing material disappear, and a healthy looking sore remains. The primary object in the speedy and successful treatment of rodent ulcer is to attack the growing edge together with some of the apparently healthy surrounding skin.

I think it is best to create a dermatitis of a severity which if it was applied to healthy skin and lupus would create a decided burn. Having purposely created this reaction it is necessary to watch the case, and consistently maintain this dermatitis. When it begins to subside another application will cause renewal. In this way the operator is able to observe the gradual disappearance of the hard-rolled edge, which it is necessary to break down. Meanwhile a healthy epithelium is forming in the central portions. Low tubes will attain the end in view, and here it should be emphasised that for the treatment of rodent ulcer the tubes used cannot be too low, for the reaction can always be regulated by varying the length of sittings. Those tubes which when warmed up show a blue fluorescence behind the anode are the most efficacious. They are undoubtedly more speedy and satisfactory than with higher vacuum tubes, though the latter will also, by longer sittings, create the reaction necessary for cure.

One case of rodent ulcer, confirmed microscopically,

which I treated, was of several years' standing. The area of disease extended beneath the left lower lid. Several weeks before I saw the case the ulcer had commenced to spread rapidly. I decided to try whether ultra-violet rays, from a Miller lupus lamp, would achieve anything where other things had failed. Owing to the peculiar situation of the disease it was exceedingly difficult to apply adequate pressure. After fourteen sittings, averaging ten minutes each, the disease was entirely banished. Sixteen months afterwards there was not the slightest indication of return, and it was only on minute examination that it was possible to discern evidence of former mischief. There is no doubt that with X-rays this case could have been cured with much less inconvenience and work than with ultra-violet rays, but the result demonstrates that the ultra-violet rays have possibilities and powers which are not confined to lupus treatment.

The Treatment of Superficial Epithelioma by X-Rays.

As regards the treatment of this ailment, I wish to say a few words indicating the progress which has been made in the treatment by X-rays. From the varying results obtained from time to time in growths which are apparently of exactly the same nature, it is difficult to lay down any hard and fast method of treatment. The discouraging results obtained, not only by X-rays but also from surgical treatment, is largely due to the fact that many of the cases put off consulting a medical man until the disease is too far advanced.

It is my firm opinion, at this stage of our knowledge of the disease, that operation gives the best chance of success, and it is only after operation has persistently been refused that X-ray treatment as a trial is justified.

There is one advantage from the X-ray treatment of these growths, and that is that it sometimes has a tendency to induce patients to seek advice in the early stages of the disease. On several occasions patients have absolutely refused operation in the first instance, but after trying X-ray treatment and finding it was ineffectual, I have succeeded in inducing them to allow me to operate. After operation I have given parts a further course of X-rays in the hope that it might act upon any small part of the growth which may have been left at the operation, and this combined method seems likely to be more effectual than by operation alone, and has been adopted by a number of workers in the subject.

Some medical confrères have endeavoured to persuade me that treating patients with X-rays after they have refused operation is an injustice, believing that they might ultimately yield to operation when they find their last hope—X-rays—

is not practised in such cases as theirs. On one occasion I followed their advice and the result affords a striking illustration of the point raised.

A man suffering from primary epithelioma of the lip consulted me. As it was a case which operation possibly would have eradicated, I absolutely declined to use X-rays, and strongly advised operative treatment; other medical men had also recommended operation, but nothing was done. Six months afterwards he returned to me with lips and secondary glands in a hopeless condition. I treated his lip condition, and after ten weeks had succeeded in apparently removing all the disease in this situation. Had I treated the case by X-rays from the first, I confidently believe that the disease by this means alone might have been eradicated, but in the event of failure I might have obtained such influence over the man as to induce him to undergo operation while there was reasonable hope of success. In such cases when operation seemed to hold out a chance of success, I have always recommended such procedure, and only when operation has been absolutely refused have I used X-ray treatment.

Most of the cases that I have treated by X-rays have been inoperable and have been sent to me to try the X-rays as a last resource. In the treatment of these inoperable cases I have not had a single final clinical success, but the experience gained by such means has not been lost, there having been partial resolution of some parts of the malignant growths. I have been enabled to draw up a plan of attack which has proved of great use in the treatment of cases which held out a hope of success, after refusing operative measures.

Three years ago I treated with X-rays a supposed epithelioma of the lower lip in an old gentleman. It had been diagnosed as malignant by two medical men, and I also diagnosed it as a cancer, but unfortunately he would not consent either to a specimen being removed for microscopical examination, or to operation. After four months' applications of the X-rays, using medium high tubes, the growth entirely disappeared, and up to the time of his death, less than six months ago of acute bronchitis, there was no indication of return either at the primary seat of the mischief in the glands or internal organs. No microscopical evidence having been available I cannot lay stress upon the success of the case, though I have not the slightest doubt that it was an epithelioma.

Another interesting case, which will be shown upon the screen, was a thorough clinical success. It is a year since stopping treatment, and up to the present there is not the slightest indication of a return of the mischief.

The man had a large epithelioma invading the whole right half of his tongue, together with the mucous membrane

of the mouth on the same side reaching forward as far as the frenum, and backwards to the second lower molar tooth. There was also some indication of the glands below the jaw on this side being enlarged. The man absolutely refused on several occasions to undergo operation. Three separate specimens were taken and sent to three microscopical authorities, the reports from each being the same, viz., epithelioma with cell nests. I commenced X-rays without any hope of success, as the disease was of so extensive a nature as to forbid the hope of permanent cure even by operation. After ten weeks' treatment all signs of the disease had disappeared, a large scar being the only indication of the former seat of mischief. I had him before the members of the Northumberland and Durham Medical Society soon after commencing treatment and after the termination of treatment, and the members were all satisfied that it was a clinical cure.

Now let us look at the other side of the question, *i.e.*, at cases operable, but where operation was refused, and where success from X-ray treatment might have been reasonably expected, and yet failure resulted.

The first case was an old lady with severe heart disease and rheumatic arthritis, who was on that account alone beyond the pale of operation. She had a very small epithelioma on the side of the middle of the tongue. I treated it carefully and consistently for nearly three months, until secondary enlargment of the glands appeared. Under treatment it grew much larger, though at first appearances seemed to indicate that it was going to be successful.

The second case was somewhat similar. It gave every hope of benefit from the X-rays which, however, only seemed to stimulate its growth.

These cases seem to indicate, as regards prognosis, that cancers which are similar clinically and microscopically, and in situation, often react differently in X-ray treatment.

From the partial success in inoperable cases one is led to believe that if some of these cases had been treated with the X-rays in an earlier stage a permanent benefit might have been the result.

From the variety of results obtained it will be seen how impossible it is to affirm anything of a definite nature in the treatment of these growths by X-rays.

Method of Treatment.

The method of treatment is an all-important consideration. It is necessary to focus the rays upon the diseased area, and also to reach some of the surrounding apparently healthy tissue. The reaction should be as severe as the circumstances

require, by using tubes varying in vacuum, and by regulating the duration of each sitting.

In my opinion there are certain of the rays absorbed by the tissues, the remainder passing through and beyond the parts dealt with, and that it is those absorbed rays which are mainly to be credited with curative effects. For this reason, in dealing with superficial malignant growths, a fairly low tube is chosen of from 1 to 3 inches alternative spark gap, the reason for this choice being that, from the severe reaction produced superficially by a low tube, it is manifest that a much larger number of the rays are arrested and absorbed by the superficial tissues than by the use of high tubes. A similar reaction from high tubes would require much longer and more frequently applied exposures, thus losing time. The healthy parts surrounding the seat of disease having been protected, exposures are so regulated as to produce in as short a time as possible a reaction sufficiently severe to break down the fungating growth, and soften its indurated edges. When these effects have been attained there is always a tendency for the immediately surrounding healthy tissue to contract upon the diseased part, which comes away in sloughs. Provided that the growth is not excessively malignant, and the patient's vitality not too lowered, this effect can always be looked for in the case of an ulcerating epitheliomatous surface.

High Frequency Currents in the Treatment of some Skin Ailments.

Owing to the varied opinions, and to various results obtained by different workers, this treatment has been of great interest to me, and I have in some diseased conditions thoroughly persevered with the applications in order that I might extract what benefit there is to be derived from them.

The brush discharges I have taken from the top of the resonator. When using the highly exhausted glass electrodes (the source of the discharge has generally been from the top of the resonator) I have sometimes used the current direct from the outside of the Leyden jars, and in order that the fullest benefit might be derived I have at the same time given general treatment with the high frequency currents from the auto-condensation chair.

Prurigo.—If this treatment is persevered with there is always an improvement and sometimes a perfect cure, especially by the use of the vacuum tubes. I have treated four cases in this way. Three of them gave me very satisfactory results.

Ulcers, Varicose, Ordinary and Syphilitic. —These generally improve under high frequency treatment, sometimes in a surprising manner. Both the brush and glass vacuum

methods will give good results. From the very commencement of treatment the ulcers assume a healthier appearance, the discharge becomes more copious, while healthy granulations spring up and soon epithelium covers over the once ulcerated surface. So far I have treated several cases, and I have not had a single failure where full opportunity to treatment has been allowed.

Blemishes of the skin are always improved by this treatment, and are sometimes completely dispersed. Dandruff formation is arrested, and the condition of the hair improved. I have used high frequency currents in dealing with eczema and psoriasis, and after a few sittings progress has been made. This takes place either with the brush or the glass electrode, though the latter is the quicker method.

I have cured several cases of granular pharyngitis by these means, and unhealthy throats quickly respond to this method. Varicose conditions in this neighbourhood are always improved, but in severe cases it will not take the place of the galvanic cautery. Keloids are always improved by the glass vacuum method, and I have succeeded in greatly improving the pitted condition of the skin sometimes following the chicken-pox eruption.

It is, however, on the treatment of lupus vulgaris and lupus erythermatosus that I wish to specially ask your attention.

Lupus vulgaris.—After thorough treatment with high frequency currents, both general and local, the condition of the skin greatly improves, especially from the use of the glass vacuum electrode, and the best results are obtained from those electrodes which are highly exhausted. I have succeeded in removing superficial patches of lupus; but after several apparent cures it has returned. I have never succeeded in removing any deeply seated nodules by this treatment, though an indurated patch has had as many as thirty applications.

Lupus erythermatosus.—In the same way I have succeeded in removing permanently, after a great amount of labour and trouble, some slight patches of disease, but the more obstinate patches are intractable to this treatment.

On the screen I will show you some unsuccessful results of this treatment.

In these ailments I now solely rely upon X-rays and phototherapy.

Radium.

I have had too little experience in the use of radium to say anything definite, except that I have succeeded in curing a small lupus patch in this way.

Radiations from the Nernst Lamp.

These are effective in removing eczematous patches. In one case I gave several thirty-minute sittings from the radiations of a large Nernst lamp. A reaction was caused, which was sufficiently severe to remove the mischief, but as only four months have elapsed since its disappearance, I cannot say anything of its permanency. It is, however, too slow a method to be of any general use.

NOTICES.

Members taking part in discussions or making remarks on papers, etc., are earnestly requested to give their notes on same to the Secretary at the end of evening, so that the proceedings may be complete and not delay the prompt publication of the Journal.

Publications.

17.—The proceedings shall be published in such a manner and at such times as the Council may direct. A copy shall be forwarded to each Honorary and Corresponding Member of the Society, and to every Ordinary Member whose subscription is not more than one year in arrear. Fourteen days' notice should, whenever possible, be given to one of the Secretaries by any member who wishes to show a clinical case or to make a communication to the Society. A copy of the paper in a form fit for publication in the proceedings must be furnished at the same time. The paper shall be the property of the Society for publication in the proceedings, without prejudice to the author's right to reprint or insert in any recognised medical paper or periodical. In all such cases the author shall state that the paper was read before the Society.

Members are reminded that the annual subscription (one guinea) became due last January and should be sent to either Honorary Secretaries at their earliest convenience.

41C
295